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News and notes should be sent to Dana Barbour, News Editor, American Statistical Association, 1757 K Street, N.W., Washington 6, D. C.

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NEWS

Atlantic City Meeting Information—Free Employment Register—New Journal Index Planned—Courses—Publications—Job Openings

Information on Atlantic City Meeting

Preregistration for Annual Meeting

All members planning to attend the annual meeting of the American Statistical Association in Atlantic City on September 10-13, 1957, are urged to make use of the preregistration form which will be mailed to the members by the Secretary-Treasurer about July 1. Preregistration will save the member the prospect of waiting in line to register and other delays. Submission of the form together with the $3.00 registration fee is all that is required.

A prepaid postcard for making hotel reservations at the Ambassador and a sheet containing information about the meeting will be included with the preregistration form.

Transportation to Atlantic City, New Jersey

Most public transportation to Atlantic City from distant points is through Philadelphia. Connections at Philadelphia for Atlantic City are good. There are seven trains a day (fewer on weekends) leaving Pennsylvania Stations at 30th Street and North Philadelphia. Buses (Public Service) leave a downtown Philadelphia terminal (a short ride from the train stations and a twenty minute ride from the airport) every hour during the day. Travel time from Philadelphia is about one and one-half hours by train and a little longer by bus.

From New York City to Atlantic City there is one direct train a day (Pennsylvania-Reading-Seashore Line) and buses every hour (Public Service). There are several direct flights (Eastern and Allegheny).

From Washington, D. C. there is very limited bus service (Greyhound) available and there are also several direct flights (Eastern and Allegheny).

Train and bus terminals at Atlantic City are a short ride from the Ambassador Hotel.

Transportation facilities to Atlantic City may be summarized as follows:

Allegheny Airlines:

New nonstop or through service from Detroit, Cleveland, Pittsburgh, Washington and New York City. Passengers from Chicago, Denver, Omaha, Salt Lake City, Minneapolis and the Northwest use Cleveland as a change-over point. Those from Dallas, Houston, St. Louis and Kansas City change at Pittsburgh for nonstop service to Atlantic City. Washington is the most convenient change-over terminal for persons coming from the South (Atlanta, Memphis, New Orleans, Dallas and Florida), again non-stop to Atlantic City.

Eastern Airlines:

Through service is available from Atlanta, Boston, Charlotte, Greensboro, Hartford, Newark, New Haven, New York City, Providence, Richmond, Washington, and Winston-Salem. All passengers from the Southwest and Midwest change over at Washington. Service is also available from Canada, New York State, and New England cities at the La Guardia Airport or Newark Airport to Atlantic City.

Pennsylvania-Reading Seashore Lines:

Through trains from practically every point on the Pennsylvania Railroad connect at the North Philadelphia Station. There are seven trains daily from North Philadelphia to Atlantic City and seven trains daily for the return trip.

Bus Transportation:

The Lincoln Bus and Public Service Transport now operate over the Garden State Parkway. There are 35 to 40 buses daily between the Port Authority Bus Terminal in New York City and Atlantic City. The trip takes approximately 2½ hours nonstop.

Automobile:

From many points, it is perhaps easier to get to Atlantic City by automobile than by public transportation. Two recently built thruways embodying the newest in highway construction bring Atlantic City close to Northern Jersey points and metropolitan New York. These highways also connect with major thruways from the Middle West, Northern New York and New England.

The Garden State Parkway is the scenic route, running all the way from the New York Thruway down the coast line of New Jersey to its tip. Leave the Parkway at Exit 40 or 36 for Atlantic City. From New York City, take the New Jersey Turnpike (which connects with the New England thruways). Change at Turnpike Exit 10 to the Garden State Parkway arriving in Atlantic City via Exits 40 or 36. From the Midwest thruways, leave the Pennsylvania Turnpike south to Exit 4 for a direct, fast route to Atlantic City via routes 73 and 30.

Convention Room Rate Schedule, Ambassador Hotel

DOUBLE ROOMS WITH BATH:

50 rooms	@	$ 8.00
60 rooms	@	10.00
100 rooms	@	12.00
90 rooms	@	14.00
10 rooms	@	16.00
70 rooms	@	18.00
20 rooms	@	20.00

Total 400 rooms

SINGLE ROOMS WITH BATH:

15 rooms	@	$ 8.00
25 rooms	@	10.00
20 rooms	@	12.00
5 rooms	@	14.00
20 rooms	@	16.00
5 rooms	@	18.00

Total 90 rooms

SUITES—PARLOR AND DOUBLE:

12	@	$20.00
20	@	36.00
18	@	45.00

Total 100 rooms

COMBINATIONS:

(Back Bldg.)

Units—2 singles — one bath	5	@	$12.00
2 doubles—one bath	24	@	16.00
2 doubles—one bath	12	@	20.00

(Front Bldg.)

2 doubles—one bath	10	@	$28.00

(same units as parlor and double $36.00)

The local arrangements committee feels that Atlantic City, the convention location this year, is an ideal place in which to combine recreational and intellectual activity. Dining, lodging and entertainment facilities are outstanding and varied. The program is stimulating and interesting. Try not to miss this opportunity to learn and relax in "America's playground."

Employment Register at Annual Meeting

The American Statistical Association has again arranged for an employment service to operate at the Ambassador Hotel in Atlantic City during the annual meeting, September 10-13, 1957. Applicants and employers are invited to use this free facility. The employment service activity this year will be under the supervision of the New Jersey State Employment Service; however, all other state employment services and the Federal employment service are cooperating. At their earliest opportunity, applicants should file applications for a job and employers should list open positions with the local office of their State Employment Service. If not filled by August 23, the local office should be asked to forward the application or job listing to the New Jersey Employment Service for the annual meeting of ASA in Atlantic City in September. After August 23, applications and orders should be withheld until arrival at the Ambassador Hotel and then registered with the Employment Service. The necessary forms will be available there. Persons who register with their local employment service prior to August 23 should be sure to check in at the Employment Service space when they arrive at the Ambassador Hotel in Atlantic City.

Publication Of 1957 Proceedings Of The B & E Statistics Section

The Board of Directors of the ASA at its May 14 meeting authorized the publication for another year of the Proceedings of the Business and Economic Statistics Section. Copies of the Proceedings for 1955-1956 are still available from the ASA national office at a price to members of $3.25.

Indexing of the Journal

Arrangements have been completed for the preparation of an analytical index of Volumes 35-50 of the *Journal* of the American Statistical Association for which a grant has been received from the Ford Foundation. The work will be done at the Virginia Polytechnic Institute under the direction of Professor Boyd Harshbarger. A Committee on the Index has been appointed to give general direction to the project. This Committee is composed of Professor William G. Cochran, The John Hopkins University, Chairman; Dr. Raymond T. Bowman, Office of Statistical Standards, U. S. Bureau of the Budget; Professor Gertrude M. Cox, University of North Carolina; Dr. Churchill Eisenhart, National Bureau of Standards; and Professor W. Allen Wallis, University of Chicago, Editor of the *Journal*.

The period to be covered by the index is 1940-1955, the *Journal* having previously been indexed to 1940. The objective is to prepare the kind of index which will be of value to scientists in the subject-matter fields represented in the *Journal*, as well as to statisticians. The principal feature of the index will be an indexing of the contents of the articles in the same way that a book is indexed by its author. Particular attention will be paid to cross-references and cross-classification, in order that the index can be used to locate quickly any work contained in the *Journal* on a specific topic. The volume will contain a complete listing of articles arranged alphabetically by author's name and giving title and location, as well as a listing of book reviews. There will also be a general index of important tables that have appeared in the *Journal*, with enough information so that the user can comprehend their content.

The work is expected to start August 1, 1957. It is estimated that 18 months will be required for completion.

Grant for Travel Expenses to International Meetings

The Carnegie Corporation of New York has made a grant of $9,000 to the American Statistical Association to be used for travel expenses of delegates to international meetings. This is one of several grants being made to professional societies for this purpose. The grant to ASA is to be spent over a period of three years. A committee is being set up by the President of the Association to advise on its expenditure.

Course In Industrial Statistics For The Process Industries

A repeat of the successful short course in Industrial Statistics for the Process Industries has been announced. It will be held July 8-19 at the University of Oklahoma under the supervision of the School of Chemical Engineering.

This course is directed specifically towards the needs of engineers and other technical people working in the process industries. Emphasis is placed on the practical applications of the various advanced statistical techniques successfully used in process control, production improvement, and experimental design. The basic concepts will be discussed and the advanced techniques will include sampling, regression and correlation analyses, experimental designs, and analyses of data.

This course is jointly sponsored by the Extension Division of the University of Oklahoma and the Chemical Division of the American Society for Quality Control. Attendance is limited to 40 people. For further information, inquiries should be directed to Dr. R. L. Huntington, School of Chemical Engineering, University of Oklahoma, Norman, Oklahoma.

Courses In Management Sciences And Computer Technology At Michigan

The College of Engineering of the University of Michigan is offering a group of intensive courses in Management Sciences and Computer Technology during the period August 19-30. The course in Management Sciences will consist of a two-week period of lectures, case studies, discussion seminars, and informal gatherings to present broadly the content of the sciences being newly applied to business problems. Introductory and advance courses will also be offered in digital computer engineering and logical design, the electronic digital computer and its applications, applications of advanced numerical analysis to digital computer problems, and applications of logic to advanced digital computer programming.

The courses are offered as a service to men in engineering, science and business, with a limited enrollment. The fee is $200. Applications for enrollment and requests for further information should be addressed to Richard C. Wilson, 2038 East Engineering Building, University of Michigan, Ann Arbor, Michigan.

Report on Activities of California Interdepartmental Research Coordinating Committee

A report on its 1956 activities was issued early this year by the California Interdepartmental Research Coordinating Committee. This Committee was established in 1945 by an executive order of the Governor of California. Its purposes were to ensure the availability of basic statistical data agreed on and used by all departments and to improve the services of the State government to users of statistical and research materials. It supplies a central clearing house for exchange of information among departments of the State government as to research that is planned or under way, it provides a way for working out procedures to correlate the research and statistical work of the departments and eliminate duplication, and it furnishes a forum for improving the technical quality of research done by State departments. The Committee currently consists of 12 members appointed by the Governor from among the principal research and statistical officers of the following State departments or boards: Agriculture, Education, Employment, Equalization, Finance, Industrial Relations, Justice, Mental Hygiene, Public Health, Public Works, Social Welfare and Water Resources.

The activities of the Committee in 1956 included a canvass of the State departments to ascertain their needs for data from the 1960 decennial census and a presentation of the needs of the State to the Director of the U. S. Bureau of the Census, a discussion of studies on older workers' employment problems, a discussion of the economic outlook for 1956-1957, and consideration of personnel classification problems involving the research and statistics activities of the several departments. At one meeting the needs of the State agencies for population estimates through 1975 were discussed. Current estimates of population by age group and by county, and projections for future years have been prepared for general State use by the Department of Finance, and the Committee has recommended to all departments that they use no estimates that are incompatible. Work also continued during 1956 on the development of a statistical abstract that will provide a compendium of verified data on the State of California comparable in scope with the annual "Statistical Abstract of the United States."

Further information about the Committee and its acivities may be obtained from the Chairman, Mr. M. I. Gershenson, Chief, Division of Labor Statistics and Research, Department of Industrial Relations, 965 Mission St., San Francisco 3, California.

U.N. Statistical Yearbook 1956

This eighth issue of the Statistical Yearbook, prepared by the United Nations Statistical Office, was published on April 8. The statistical authorities in 151 countries or territories, as well as the U.N. specialized agencies and other inter-governmental bodies co-operated actively in its preparation.

The "Statistical Yearbook 1956" runs to 646 pages and contains 187 tables—more than in any preceding issue—relating to demographic, economic, financial, social and cultural subjects, generally covering a 20-year period

ending 1955 or mid-1956. There are also subject and country indexes, and an appendix devoted to conversion factors. New tables relate to the production of cobalt ore (Co content), to international tourist travel (arrivals of visitors in some 60 countries, 1947-1955) and private consumption expenditure. Tables reinstated are those on production of canned and salted fish, and railway rolling stock in use (last given in the 1953 issue). Data on tanker tonnage have been added to the tables on merchant shipping fleets and tonnage launched, a section on assembly from imported parts to the table on motor vehicle production, data on weekly and monthly earnings to the table on hourly earnings in manufacturing, and world totals to the tables on fish catches, meat production and civil aviation. The receipt of extensive statistics from the USSR, Bulgaria, Hungary and Poland, together with recently published data for China Mainland, have enabled the Yearbook to give up-to-date figures for these areas in many tables and to further improve the accuracy and comprehensiveness of the world totals.

The "Statistical Yearbook 1956" may be purchased at $6.00 paperbound or $7.50 clothbound, from the International Documents Service, Columbia University Press, 2960 Broadway, New York 27, N.Y.

ISI Dictionary Of Statistical Terms

"A Dictionary of Statistical Terms" has been published recently for the International Statistical Institute. This dictionary, which was prepared by Maurice G. Kendall, Professor of Statistics in the University of London, and W. R. Buckland, forms part of a program of statistical education initiated by the I.S.I. in 1949 in response to a request from the Statistical Commission and the Economic and Social Council of the United Nations, acting through the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The Dictionary is in two parts—a dictionary of terms and definitions in English, and four glossaries of equivalent terms (without definitions) in French, German, Italian and Spanish. There are numerous cross-references in the main body of definitions to help in the study of associated terms. In addition to purely statistical terms, the Dictionary includes some mathematical terms commonly used by the statistical profession, as well as terms originating in other sciences that are of special interest to statisticians.

The Dictionary has been published by Oliver & Boyd in Great Britain, and by the Hafner Publishing Company in the United States. The list price in the U.S. is $4.50 per copy.

Job Openings

The Naval Proving Ground has openings for Mathematical Statisticians and Mathematicians to work on challenging assignments in the field of naval ordnance. Appointees will work in an established and growing laboratory which has been assigned an important part in the development of weapons and weapon systems for the Navy. Statisticians in the laboratory provide local consultation on the statistical planning and assessment of ordnance tests and evaluation studies; develop and introduce statistical methodology in naval ordnance; develop capabilities in operations research and weapons evaluation; and formulate general statistical routines for the Naval Ordnance Research Calculator, the world's fastest electronic computer. The starting salary is $4525 through $7570 for qualified statisticians and mathematicians. Inquiries should be addressed to: Industrial Relations Director, Naval Proving Ground, Dahlgren, Virginia. A resume of qualifications and experience should be given, preferably on a Civil Service Form 57 (which can be obtained at any U. S. Post Office).

The City of Philadelphia wants a qualified statistician for work in the new Alcoholic Unit at the Philadelphia House of Correction and for coordinating information from the three Philadelphia prisons. Duties include planning data collection, including sampling techniques; evaluation and interpretation of statistical data; preparation of reports, including graphs, charts and diagrams; and related work as required. Applicants must (1) have graduated from a four-year college or university, including or supplemented by a major course program in statistics; or (2) have graduated from a four-year college or university, including course work in statistics, and had one year of professional experience in performing statistical research and analysis work in a public or private agency. The starting salary is $4400. Inquiries should be addressed to Mr. Joseph P. McGowan, Personnel Officer, Office of the Superintendent of Prisons, Department of Public Welfare, 8001 State Road, Philadelphia 36.

RESERVE SEPTEMBER 10-13 FOR THE 1957 A.S.A. ANNUAL MEETING IN ATLANTIC CITY, NEW JERSEY

FEDERAL STATISTICAL ACTIVITIES

National Health Survey

Household interviewing for the National Health Survey Program began on a nationwide basis early in May. This is the first of the three parts of the Program to get underway on a full scale. Meanwhile, the other two parts —special studies and methodological studies—have moved forward to the point that contracts for two special projects have been made. The National Health Survey Program is being directed by the Public Health Service's Division of Public Health Methods, pursuant to legislation enacted last summer.

Survey design and procedure

The field work in the household survey is being done for the Public Health Service by the Bureau of the Census, which also designed the sample and will be responsible for processing of the data. The household interviewing will proceed on a continuing basis to provide quarterly morbidity statistics for the United States and, at least every 2 years, for 3 population-size classes in each of 11 geographic sections and for the 8 standard metropolitan areas which had more than 2,000,000 population in 1950.

During the first two months—a "dry run" period—interviewing will be carried on in the 330 Primary Sampling Units which are used for the Census Bureau's Current Population Survey. Each of the Primary Sampling Units comprises a single county or group of counties. Each standard metropolitan area, as defined in 1950, comprises a single Primary Sampling Unit.

At the end of the "dry run," the sample will be changed to 372 Primary Sampling Units, and this enlarged sample will be the basis for compilation of data. Within the sample, about 72,000 dwelling units and other listings units will be selected within a 2-year period, and each unit will be interviewed once. These sample units will be clustered in segments comprising an expected 6 dwelling units. The sample dwelling units will, in some cases, comprise compact clusters and, in other cases, will be subsampled from clusters containing a multiple of the number of sample dwelling units. The method of selection insures that there will be no overlap at any time between the National Health Survey households and those in the Current Population Survey (except, of course, for persons who may have moved from one location to another).

Survey questionnaire

The schedule for the household interview carries a group of questions with regard to illness and injuries occurring in the past two weeks and the amount of medical and dental care received in the same period. Questions concerning chronic conditions and hospitalized illness relate to the 12 months prior to the interview. Respondents are also asked to report the existence of physical impairments at the time of the interview. For each illness, injury, and chronic condition, information is sought on the nature of the trouble, medical attendance, disability, and date of onset. For accidents resulting in injury, the broad class of accident—automobile, home, work, or other—is determined. Chronically ill persons are classified according to the extent that their activities and mobility are limited.

In-patient hospitalization is recorded in sufficient detail to show dates of admission, length of stay, the number of hospitalizations, the care or treatment received, and the name and location of the institution.

Information on demographic and personal characteristics gathered in the household interviews will include age, sex, race, place of birth, marital status, veteran status, educational attainment, usual activity, annual family income, and whether the dwelling place is on a farm or ranch.

The questionnaire for national use in the Survey benefited by a pretest conducted early this year in Charlotte, North Carolina. In that pretest a comparison was made of results from the use of two different rules concerning which persons in the household would be considered acceptable respondents. The Charlotte pretest also permitted the Census Bureau and Public Health Service staffs to observe how certain forms of key questions worked out in practice; and it gave valuable training to 17 regional Census Bureau supervisors for the National Health Survey.

Special and methodological studies

The first of the special projects contracts was made with the National Office of Vital Statistics. The NOVS will conduct a pilot investigation of methodological and other problems in obtaining data on the hospital and medical services which had been received by decedents, with a view to establishing a continuing collection of such data. The hospital and medical services received by persons who have died is not covered by the data derived from interviewing the living population in the National Health Survey. Since a large amount of hospital and medical services, particularly in the older age groups, is received by decedents, the Survey needs to include their experience to describe fully the utilization of such services. After selection of a sample of death certificates, data about these decedents is to be collected by a mail survey of appropriate sources, followed by personal interviews for nonrespondents and a sample of respondents, for validation purposes. Primarily emphasis will be on

hospital and medical care, but the project will also explore the feasibility of collecting for decedents other information to be collected for the living population.

A second contract—with the Health Insurance Plan of Greater New York (H.I.P.)— calls for a methodological study in questionnaire response, designed to test how accurately certain health information is reported in household interviews. Medical and hospital records for a sample of H.I.P. enrollees will be compared with the information these people furnished on interview in a study of health and medical care conducted for H.I.P. in 1952. Accuracy will be judged upon the amount of agreement between what the individual stated in a household interview and what appears on the H.I.P. medical records. The investigation will also cover differences for self-respondents as compared with persons not responding for themselves; any apparent correlation of age, sex, educational status, or recency of illness with the accuracy of reporting; and an attempt to ascertain possible factors to account for the quality of the reporting in household interviews. The H.I.P. will incorporate its findings in a technical report to the Public Health Service.

—FORREST E. LINDER, *Director, National Health Survey Program, Public Health Service, Department of Health, Education, and Welfare*

Development of Long-Range Statistical Program

The Bureau of the Budget has requested statements on long-range statistical programs from agencies of key importance to the Federal statistical system, as an aid in more systematic planning of the Government's statistical program. The request was made in letters from the Director of the Bureau of the Budget, dated March 19, to the Secretaries of Agriculture, Commerce, HEW, Interior, Labor, and Treasury to cover the following organizational units:

Agriculture—
- Agricultural Marketing Service (Agricultural Economics Division and Agricultural Estimates Division)
- Agricultural Research Service (Production Economics Research)

Commerce—
- Bureau of the Census
- Business and Defense Services Administration
- Office of Business Economics

Health, Education, and Welfare—
- Office of Education
- Public Health Service (Office of the Surgeon General and National Office of Vital Statistics)

Interior—Bureau of Mines

Labor—
- Bureau of Labor Statistics
- Bureau of Employment Security

Treasury—Internal Revenue Service

For each of the major statistical programs conducted by these agencies the statements will include: (1) a brief description of the present program and current annual level of expenditures; and (2) recommendations for a long-range program, to be developed over the fiscal years 1958 through 1962. It is requested that the statement on the long-range program should evaluate important series in terms of uses of the data and include proposals for significant changes—such as major revisions needed or corrections of present weaknesses—with indication of the timing contemplated, priorities among different items, and approximate cost estimates. For each activity the statement should also indicate any possible curtailments or discontinuances which can be foreseen at the present time.

The primary purpose of the statement is to help the Bureau of the Budget develop an over-all plan for the Government's statistical programs, taking into account improvements most needed in terms of present needs and uses. Achievement of an improved and integrated program, with better balance among its component parts, requires that plans be made with greater attention to interrelationships and relative priorities than can be given on a year-to-year basis. The recommendations for long-range programs made at this time will be subject to modification in future statements, and the estimates of future costs are intended to indicate the general magnitudes involved, not to serve as a basis for budget requests. The timing for adoption of any part of the over-all plan will be subject to budget policy for specific years.

—RAYMOND T. BOWMAN, *Assistant Director for Statistical Standards, Bureau of the Budget*

Federal Reserve Study Of Consumer Instalment Credit

The Board of Governors of the Federal Reserve System has published in four parts a six-volume report of a broad investigation of consumer instalment credit. The first five volumes were made available in mid-March; the sixth and final volume analyzing the results of a detailed survey of new car purchases and their financing was released in preliminary publication form in early May and in final printed form in June.

The central problems investigated in the study are the role of consumer instalment credit in economic growth and instability, and the issues involved in reaching a decision for or against a standby legislative authority to regulate instalment credit. The report includes much new

factual and analytical data compiled from various sources, including several new national surveys. The study was undertaken at the request, made in February 1956, of the Chairman of the Council of Economic Advisers, on direction of the President. Interest in the study was also expressed by the Joint Economic Committee and the Banking and Currency Committees of both the Senate and the House of Representatives.

The six volumes of the published report are described below. The volumes may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. at the prices indicated.

Part I (2 vols.)—*Consumer Instalment Credit: Growth and Import*

Part I was prepared by the research staff of the Federal Reserve System, under the direction of Ralph A. Young, Director of the Board's Division of Research and Statistics, with Kenneth B. Williams, Assistant Director, serving as coordinator of staff work.

Volume 1 (388 pages, $1.25) presents an integrated study of instalment credit processes and issues of regulation. It examines the characteristics of the users and the suppliers of instalment credit, in both cross-section and historical perspective; the relation of instalment credit, and of changes in credit terms, to growth and instability of consumer and aggregate demand; the burden of instalment credit on individual debtors and on the economy as a whole; the relation of instalment credit to the credit market; history and experience with war and postwar regulation, including the question of discrimination; prospects for future growth; and the conflicting viewpoints on issues of regulation drawn from the scholars who collaborated in the investigation, from earlier empirical and theoretical work, and from the views of leaders in the instalment credit business and financial community.

Volume 2 (287 pages, $1.00) comprises six supplemental reports that investigate certain aspects of the study in more detail. One report analyzes the financial structure of sales finance companies and other consumer lending agencies and the operating characteristics of banks actively engaged in consumer financing, compared with those less actively engaged. A second investigates the responsiveness of instalment credit to changes in general credit conditions. A third presents the findings of a Federal Reserve Bank survey of some 600 automobile dealers, designed to illuminate relationships between dealers and lenders in instalment financing as well as practices of dealers in extending instalment credit and in influencing its terms. A fourth summarizes the results of a national survey of 26,000 households undertaken by the Bureau of the Census to ascertain the characteristics of credit and cash purchasers of new and used automobiles, homes, and selected other consumer goods in the period January 1954 to mid-1956. A fifth report deals with the role of instalment credit and the methods of regulating it in foreign countries. A final report considers alternative statutory approaches to instalment credit regulation.

Part II (2 vols.)—*Consumer Instalment Credit: Conference on Regulation*

Part II comprises a set of 37 analytical and discussion papers by university scholars, presented in a Conference on "The Problem of Consumer Credit Regulation" organized by the National Bureau of Economic Research, at the request of the Board of Governors. Geoffrey H. Moore, Associate Director of Research of the National Bureau, served as chairman and organizer of the Conference, which was held on October 12 and 13, 1956. The chief questions considered by the Conference authors are: What part does consumer credit play in the upswings and downswings of business activity? Has consumer credit fostered or retarded economic growth? What interconnections exist between consumer credit and other parts of the financial system? What differential impact does consumer credit have on the activities of individuals or families that are variously circumstanced with respect to income, wealth, age, and so forth? And how does it affect the fortunes of business enterprises of various sizes in various lines of activity?

The Conference papers are presented in two volumes, prepared under the independent auspices of the National Bureau of Economic Research.

Volume 1 (553 pages, $1.75), "The Position of Consumer Credit in the Economy and Its Bearing on the Problem of Regulation," includes individual papers dealing with relations between instalment credit and economic fluctuations; the changing quality of instalment credit and economic fluctuations; the relation of consumer credit to long-run economic growth; analysis of consumer credit expansion; sources of instalment credit funds and responses to credit market conditions; characteristics and attitudes of the users of consumer credit; and market practices of business enterprises offering consumer credit.

Volume 2 (162 pages, 60 cents) deals with "The Pros and Cons of Consumer Credit Regulation." The papers in this volume weigh such issues as (1) whether or not certain undesirable consequences of an unfettered development of consumer credit could be eliminated or alleviated by the imposition of controls at appropriate times; (2) whether or not such controls could create other undesirable effects; and (3) whether or not alternative economic policies would produce more desirable results than standby controls. The pro and con arguments are presented in four major papers—two in favor and two opposed—with eleven comment papers.

Part III—Views on Regulation

Part III (230 pages, $1.00) reports the results of an independent survey of the views of the consumer credit industry and others on the public policy aspects of instalment credit regulation. The survey was made by George D. Bailey, partner in the firm of Touche, Niven, Bailey and Smart, who acted as a special consultant to the Board of Governors. The survey was intended as a gathering of judgments and opinions and of the reasoning underlying the views held by the various consumer credit trade groups and of others closely affected, rather than as a representative national sampling of all views on regulation. About 800 replies were received (from some 2,000 letters sent out) covering different geographical locations and smaller companies and communities as well as the larger. The views obtained are summarized in separate sections for each of the following groups: trade associations, commercial banks, sales finance companies, consumer finance companies, manufacturers, department stores, mail-order companies, automobile dealers, furniture stores, appliance and radio-TV dealers, jewelry stores, power and light companies, and consumer groups.

Part IV—Financing New Car Purchases

Part IV (151 pages, 60 cents) presents the results of a representative national survey of new car buyers in 1954-55, involving interviews with some 4,600 cash and credit purchasers and also the collection from lenders' records of financing data on some 5,700 instalment credit transactions. This survey, which focused directly on new car purchases, was undertaken to throw light on the key influences operating to make instalment credit developments so unusual in that period. The automobile instalment financing business underwent one of the major liberalizations of new car credit terms in its history. New car purchases rose sharply from 1954 to 1955 to a record level with four-fifths of the rise representing credit purchases. Moreover, new car instalment credit was a large factor in the record-breaking expansion in total instalment credit. The report offers information, on contract and effective prices of new cars, changes in buyers practices, income and other characteristics of buyers, credit terms, sources of credit, finance and insurance charges, downpayments and monthly payments, and retrospective attitudes of purchasers to their auto "deals" and financing arrangements. The survey field work was carried through by or under direction of National Analysts, Incorporated, in cooperation with the Board's research staff which was responsible for the planning of the study, analyzing the results and writing the report.

—KENNETH B. WILLIAMS, *Assistant Director, Division of Research and Statistics, Board of Governors of the Federal Reserve System*

Census Bureau Population Estimates

A number of reports presenting population estimates for the United States as a whole, States, and selected cities and counties have been issued by the Bureau of the Census in the P-25 series of its Current Population Reports.

For the United States as a whole, Series P-25 No. 153 (published March 1957) gives monthly estimates for the period January 1, 1950-February 1, 1957 of (1) total population including armed forces overseas, (2) total resident population, and (3) civilian population. This report also presents annual and quarterly data on the components of population change (births, deaths, and net civilian immigration) for 1950-1956 and semiannual (January 1 and July 1) population totals and estimates of the components of population change for the decade 1940-50. Series P-25 No. 146 (published November 1956) gives postcensal estimates of United States population by age, sex, and color for July 1 of the years 1950-56.

For States, Series P-25 No. 151 (published February 1957) gives limited age data for 1955, with figures for the groups under 5 years of age, 5 to 17 years, 18 to 34 years, 35 to 44 years, 45 to 64 years, and 64 years and over; and for the groups 14 years and over, 18 years and over, and 21 years and over. Series P-25 No. 148 (published November 1956) gives provisional estimates for July 1, 1956 of the civilian population of the States and of Alaska, Hawaii, and Puerto Rico; and also of total resident population of the States. Series P-25 No. 145 (published October 1956) gives annual midyear estimates for 1950-55 of the population of each State and of Alaska, Hawaii, Puerto Rico, Canal Zone, and the Virgin Islands. Estimates of the components of population change are also given for States.

For cities and counties, estimates for selected standard metropolitan areas were prepared for the Federal Civil Defense Administration as part of a larger study of civil defense planning. Series P-25 No. 137 (published May 1956) gives estimates of the January 1, 1956 population of the standard metropolitan areas of Houston, Milwaukee, St. Louis, and Washington, by constituent parts. Series P-25 No. 155 (published April 1957) gives estimates of the July 1, 1956 population of the standard metropolitan area of Providence, by constituent parts; and Series P-25 No. 156 (published April 1957) gives similar estimates for New Orleans.

Copies of these reports may be obtained from the Population Division, Bureau of the Census, Washington 25, D. C.

—JACOB S. SIEGEL, *Chief, Population Estimates and Projections Branch, Population Division, Bureau of the Census, Department of Commerce*

OBE Report on Personal Income by States

A comprehensive report on "Personal Income by States since 1929" was issued on March 18 by the Office of Business Economics, Department of Commerce, as a supplement to the *Survey of Current Business*. The income series presented provide an annual record for each State for the years 1929 through 1955, with overall figures on total and per capita personal income and detailed sources of income by type and by industry. Special estimates of disposable personal income are also included, to facilitate analysis of the State distribution of purchasing power.

The State income estimates detailed for the first time in this Supplement represent a complete revision of the State income payment series initiated by OBE in the late 1930's. The new personal income measures embody a thorough reworking of the statistics back to 1929, utilizing additional data sources and improved estimating techniques resulting in significant improvements in the statistical basis of the figures. The report contains five parts:

Part I, "The State Income Distribution and Its Changing Pattern," measures and analyzes the economic growth of States and regions over the past quarter century.

Part II, "A General View of the Estimates," contains a summary discussion of the concept, statistical derivation and reliability of the State income estimates.

Part III, "Definitions and Terms," explains the conceptual basis of the estimates, with separate consideration of the various components making up the total.

Part IV, "Sources and Methods of Estimation," provide a detailed explanation of the mcthodology, organized into four sections by type of income—wage and salary disbursements, proprietors' income, property income, and other components.

Part V, "Statistical Section," contains 78 tables giving a more precise and detailed picture of State income flows than has been available heretofore. The section includes summary tables showing personal income, per capita income, and population, by States and regions for 1929 through 1955; tables for the United States, each region, and each State, showing personal income by major sources, 1929-55; and a group of special tables showing income by industrial source, by States and regions for selected years since 1929.

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in detail in the report, are summarized by area in the following table:

Table 1

	Total Personal Income		Per Capita Disposable Income	
	Percent increase, 1929-55	Percent of national total, 1955	Percent increase 1929-55	Percent of national average 1955
U.S. (Continental)	*254*	*100.00*	*163*	*100*
New England	182	6.62	138	113
Mideast	183	25.62	120	116
Great Lakes	245	23.01	159	113
Plains	222	8.06	188	89
Southeast	364	15.26	251	70
Southwest	374	6.65	234	86
Rocky Mountain	307	2.16	183	91
Far West	418	12.62	141	119

Copies of "Personal Income by States" (229 pages, $1.50) may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., or through the field offices of the Department of Commerce.

BLS Reports on Effects of $1 Minimum Hourly Wage

The Bureau of Labor Statistics has issued the first of the reports on the series of industry and locality studies initiated last year to measure the economic effects of the increase in the Federal minimum wage to $1 an hour. The BLS studies are part of a broad program undertaken by the Department of Labor in response to a Congressional request for an evaluation and appraisal of the new minimum wage established by the 1955 amendments to the Fair Labor Standards Act.

Industry studies are being made in twelve low-wage industries, mostly in the South. Reports have now been issued on the initial effects of the higher minimum wage for the following industries: Fertilizer Manufacturing (No. 111); Seamless Hosiery (No. 112); Southern Sawmills (No. 113) and Footwear, Processed Waste, Wooden Containers, and Work Shirts (No. 115). These reports provide wage distributions for nonsupervisory employees, earnings in selected jobs, supplementary wage practices, and information on changes in hiring and employment practices and introduction of labor-saving equipment. Pay periods shortly before and after March 1, 1956 (the effective date of the $1 minimum hourly wage) were covered, with some variation for seasonal industries. Two remaining reports are in preparation for release this summer—one on the dress shirt industry and the other covering the canning and freezing, cigar, raw sugar, and tobacco stemming industries.

Locality studies are being made in ten comparatively small communities with industries substantially affected by the $1 minimum wage. Reports have been issued for Burlington, Vt. (No. 114-1); Millville, N. J. (No. 114-2); and Athens, Ga. (No. 114-3). Reports will be issued in the next few weeks for Dalton, Ga. (No. 114-4); Sunbury-Shamokin-Mt. Carmel, Pa. (No. 114-5); Dothan, Ala. (No. 114-6); Hickory, N. C. (No. 114-7); Fort Smith, Ark. (No. 114-8); Meridian, Miss. (No. 114-9); and Spartanburg, S. C. (No. 114-10). The reports show earnings distributions of employees by broad occupational groups and selected jobs, separately for industries generally covered by the Fair Labor Standards Act and industries not covered, for pay periods shortly before and after March 1, 1956.

Copies of the industry and locality reports may be obtained from the Bureau of Labor Statistics, Washington 25, D. C. Follow-up surveys are being made this spring for both the industry and the locality studies to obtain information on longer run effects of the increase in the minimum hourly wage.

—H. M. Douty, *Chief, Division of Wages and Industrial Relations, Bureau of Labor Statistics, Department of Labor*

Recent Publications

Transportation and Distribution of Products by Canned Fruits and Vegetables Industry: 1954, issued by the Bureau of the Census, Department of Commerce. Report on a survey of the transportation and distribution of products by the canned fruits and vegetables industry in 1954, undertaken primarily to test and develop a method which could be used for nearly all types of shippers. Systematic sampling procedures were used at two levels —first a sample of plants or companies, drawn from schedules submitted in the 1954 Census of Manufactures; and second, a sample of sales invoices or shipping papers within each selected plant, from which detailed information was obtained. Tables in the report show: relative volumes of canned foods moved by railroad, motor carrier, private truck, and other means of transportation from point of production to customer or redistribution point; distribution of manufacturers' sales by major market channels (multiunit retail, other retail, wholesale, interplant, etc.); volume of interregional trade; distance between point of production and markets; and relative volumes of products shipped to receivers in standard metropolitan areas (over 50,000) and in other areas classified by size (10,000-50,000 and less than 10,000). Available from Bureau of the Census, Washington 25, D. C., at 50 cents a copy.

New Financing in 1957 (Statistical Series Release No. 1443), issued by the Securities and Exchange Commission. Release presenting results of a survey of new financing in 1957, made as part of the annual survey of business capital expenditures. Data collected include estimates of anticipated financing for 1957 by type of

financing and comparisons with past years, as reported by manufacturing corporations and public utilities from late January to early March 1957. The survey sample provides almost complete coverage of public utilities and most of the larger manufacturing concerns. This is the first publication of a release on anticipated financing, and it is intended to conduct similiar studies in future years to provide broader experience for the interpretation of results. Available from Publications Unit, Securities and Exchange Commission, Washington 25, D. C.

Earnings and Supplementary Benefits in Hospitals—Results of surveys by Bureau of Labor Statistics in cooperation with the Women's Bureau, Department of Labor, of earnings and related benefits of nurses and other hospital employees, in 16 major metropolitan areas. Data were obtained from representative hospitals (selected on the basis of size, type of service, and proprietorship) on occupational earnings, perquisites (meals, room, laundry, uniform), minimum weekly salaries and entrance rates, shift differential provisions, scheduled weekly hours, overtime pay practices, paid vacations and holidays, insurance and pension plans. The 16 major metropolitan areas in which the surveys were conducted are: Atlanta, Baltimore, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Memphis, Minneapolis-St. Paul, Los Angeles-Long Beach, New York, Philadelphia, Portland (Oregon), San Francisco-Oakland, and St. Louis. Preliminary reports have been issued for each of these areas, and are available on request to the Bureau of Labor Statistics, Washington 25, D. C. Final results will be issued as a series of BLS Bulletins during the late spring and summer of 1957, available as sales documents from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Bulletins have been issued for St. Louis (Bulletin No. 1210-1) and Portland, Oregon (Bulletin No. 1210-2) and are available at 20 cents each.

Union Wages and Hours in Building Trades (BLS Bulletin No. 1205), issued by the Bureau of Labor Statistics, Department of Labor, presenting results of the 50th annual survey of union scales and hours in the building trades. The report presents union scales and hours in effect on July 1, 1956, covering approximately 695,000 journeyman and 165,000 helpers and laborers in 52 cities with populations of 100,000 or more. In addition, indexes of union hourly wage rates and weekly hours on a 1947-49 base are provided for the half century interval 1907-56 for all trades combined and separately for journeymen and laborers and helpers. Indexes for 12 individual journeymen trades and 3 laborer classifications also cover the entire period. Two charts show movement of scales over the 50-year period. Available from Superintendent of Documents, Government Printing Office, Washington 25, D. C., at 35 cents a copy. Preliminary city data available without charge from Bureau of Labor Statistics, Washington 25, D. C.

Reviews of Data on Research and Development, new series of reports issued by the National Science Foundation. The first issue, released in January, deals with expenditures for research and development in the United States in 1953, and summarizes data obtained from surveys conducted by or under the auspices of the Foundation of expenditures by the Federal Government, colleges and universities, foundations and other institutions, and industry-oriented organizations. The second issue, released in April, deals with research and development in colleges and universities generally; and the third, released in May, with research and development in medical schools. The fourth issue, released late in May, deals with the exchange of foreign and American graduate students in the sciences, engineering, and other fields. Available from Office of Special Studies, National Science Foundation, Washington 25, D. C.

STATISTICIAN

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NONPARAMETRIC STATISTICS*

SIDNEY SIEGEL

The Pennsylvania State University [1]

In the development of modern techniques of statistical inference, the first tests to gain prominence and wide use were those which make a good many assumptions, and rather stringent ones, about the nature of the population from which the observations were drawn. The title of these tests—*parametric*—suggests the central importance of the population, or its parameters, in their use and interpretation. These tests also use the operations of arithmetic in the manipulation of the scores on which the inference is to be based, and therefore they are useful only with observations which are numerical. The t and F tests are the most familiar and widely used of the parametric tests, and the Pearson product-moment correlation coefficient and its associated significance test are the most familiar parametric approaches to assessing association.

More recently, *nonparametric* or "distribution-free" statistical tests have gained prominence. As their title suggests, these tests do not make numerous or stringent assumptions about the population. In addition, most nonparametric tests may be used with non-numerical data, and it is for this reason that many of them are often referred to as "ranking tests" or "order tests." Many nonparametric tests use as their data the ranks of the observations, while others are useful with data for which even ordering is impossible, i.e., classificatory data.

Some nonparametric methods, such as the χ^2 tests, the Fisher exact probability test, and the Spearman rank correlation, have long been among the standard tools of the statisticians. Others are relatively new, and therefore have not yet gained such widespread use. At present, however, nonparametric tests are available for all the common experimental designs.

The purpose of the present paper is not to discuss the rationale and application of the various nonparametric tests. That has been done, at various levels of sophistication and with varying degrees of comprehensiveness, in other sources (2, Chap. 17; 3; 6, Chap. 16; 7; 8; 9; 10; 11; 13). Rather, the purpose is to discuss, at a non-technical level, certain issues which have arisen in connection with the use of nonparametric tests. In particular, issues are discussed which are relevant to the choice among alternative tests, parametric and nonparametric, applicable to the same experimental design.

* EDITOR'S NOTE: Articles of an expository, nontechnical nature similar to this one are desired in the "newer" fields in statistics for possible publication in *The American Statistician.*

[1] At the Center for Advanced Study in the Behavioral Sciences, Stanford, California, for the 1957-1958 year.

Power

When alternative statistical tests are available to treat data from a given research design, as is very often the case, it is necessary for the researcher to employ some rationale in choosing among them. The criterion most often suggested is that the researcher should choose the most powerful test.

The *power* of a test is defined as the probability that the test will reject the null hypothesis when in fact it is false and should be rejected. That is,

Power = 1 — probability of a Type II error

Thus, a statistical test is considered a good one if it has small probability of rejecting H_0 the null hypothesis when H_0 is true, but a large probability of rejecting H_0 when H_0 is false.

However, there are considerations other than power which enter into the choice of a statistical test. One must consider the nature of the population from which the sample was drawn, and the kind of measurement which was employed in the operational definitions of the variables of the research. These matters also enter into determining which statistical test is optimal for analyzing a particular set of data.

It is suggested here that the choice among statistical tests which might be used with a given research design should be based on these three criteria:

1. The statistical model of the test should fit the conditions of the research.
2. The measurement requirement of the test should be met by the measures used in the research.
3. From among those tests with appropriate statistical models and appropriate measurement requirements, that test should be chosen which has greatest power-efficiency.

The Statistical Model

When we have asserted the nature of the population and the manner of sampling in the research, we have established a statistical model on the basis of which we may conduct a statistical test. The validity of the conclusion based on the statistical test depends on whether or not the conditions of the statistical model underlying the test are met. That is, the conclusion based on a statistical test carries a qualifier: "If the model used was correct, then we may conclude that . . ."

Sometimes the researcher is able to determine whether the conditions of a particular statistical model are met in his research, but more often he simply has to assume that they are met. Thus the conditions of a statistical

model of a test are often called the "assumptions" of the test.

The model underlying the common parametric tests, the t and F tests, imposes these conditions: (a) the observations must be independent, (b) the observations must be drawn from normally distributed populations, (c) these populations must have the same variance, or, in special cases, they must have a known ratio of variances, and (d) in the case of the analysis of variance, the means of these normal and homoscedastic populations must be linear combinations of effects due to columns and/or rows—the effects must be additive. In addition, as we shall note further below, the nature of the t and F tests also imposes a measurement requirement: a test on the means imposes the requirement that the measures must be additive, i.e., numerical.

As we have already noted in the discussion of their title, the nonparametric tests are not based on a statistical model which specifies such restrictive conditions. In addition to assuming that the observations are independent, some nonparametric tests assume that the variable under study has underlying continuity. Moreover, the measurement requirement of nonparametric tests is weaker; as will be shown, most nonparametric tests require either ranking or classificatory measurement.

Compared to the models underlying parametric tests, the models underlying nonparametric tests are far less restrictive, and therefore the conclusions based on nonparametric inference are more general. When a parametric test, say the t test, is used for inference, we must preface our conclusions with a statement like "If the observations are truly numerical, and are drawn from normally distributed populations which are equal in variance, then we may conclude that . . .", whereas when a nonparametric test is used for inference, we may say, "Regardless of the nature of the underlying populations, we may conclude that . . ."

By the criterion of generality, then, the nonparametric tests are preferable to the parametric. By the single criterion of power, however, the parametric tests are superior, precisely because of the strength of their assumptions; with data for which the strong and extensive assumptions and requirements associated with the parametric tests are valid, these tests are most likely of all tests to reject H_0 when H_0 is false.

Attracted by the power of parametric tests, and seeking to justify their use of these tests with their data, researchers have developed certain approaches in an attempt to determine whether the assumptions of the parametric tests are valid for their data.

For example, in connection with the assumption that the scores are drawn from a normally distributed population, it is common practice to test the normality of the distribution of the scores in the sample by use of say the χ^2 goodness of fit test. If this test does not lead to the rejection of H_0, the researcher concludes that he may safely use tests whose statistical models pose the condition that the population must be normally distributed. At least two objections to this procedure may be raised: (a) it involves an attempt to "prove" the null hypothesis that the sample is from a normally distributed population—the statistical test is employed in order to enable the researcher to *accept* that H_0, and (b) ambiguous and difficult situations arise when the obtained probability of deviations from normality as large as those observed in the sample is close to the arbitrarily set significance level.

Similar objections may be raised to comparable attempts to justify the homoscedasticity assumption by attempting to "prove" the null hypothesis that the variances of the two or more samples do not differ.

When the investigator's test of his data indicates that the obtained sample of scores could well have been drawn from a population which is not normal, his earnest wish to justify the use of the most powerful test leads him to alter the distribution of scores. By a mathematical operation on the original scores, he "transforms" them so that the normality assumption becomes tenable. The question which must be raised in connection with such an attempt is this: Will the process of "normalizing" the distribution by altering the numerical values of the scores cause a distortion of the experimental effect under investigation? This is a question which the investigator may or may not be able to answer. If the process of transforming the scores has the effect of diminishing the experimental effect, then the investigator has placed himself in a paradoxical situation. The steps he has taken in order to justify the use of a statistical test which has maximum capacity to reject H_0 when it should be rejected are steps which have reduced the sensitivity of the measurement and have thereby reduced the likelihood that H_0 will be rejected when it should be. That is, his efforts to gain power paradoxically result in a loss of power.

When the research involves the comparison of scores in two or more samples and when a test of their variances renders the homoscedasticity assumption questionable, the procedure of transforming scores in order to justify that assumption is open to the same objection.

When we have reason to believe that the conditions of the parametric model are met in the data under analysis, then we should certainly choose a parametric statistical test, such as a t or F test, for analyzing those data, because of the power of parametric tests. But if the assumptions of the test are not met, then it is difficult if not impossible to say what is really the power of the parametric test. It is even difficult to estimate the extent to which a probability statement

about the hypothesis is meaningful when that probability statement results from the inappropriate application of the test. Although some empirical evidence has been gathered to show that slight deviations in meeting the assumptions underlying parametric tests may not have radical effects on the obtained probability figure, there is as yet no general agreement as to what constitutes a "slight" deviation.

Measurement

The computation of any statistic involves performing certain manipulations of the research data. To compute a mean, for example, we perform the arithmetic manipulations of addition and division on the scores.

The manipulations to which observations may meaningfully be subjected depend on the sort of measurement which the observations represent. For example, if the observations represent non-numerical measurement, the computation of a mean to represent the central tendency of the observations introduces distortion.

Different statistical tests require different kinds of manipulations of the research observations, and therefore different statistical tests are useful in making inferences from data representing measurement of different strengths or levels.

Levels of measurement. In general, we can clearly define at least four distinct levels at which measurement may be achieved (12), when measurement is understood to mean the process of assigning symbols to observations in some consistent manner.

Measurement is weakest when the objects in the universe are simply partitioned into mutually exclusive classes. This system of classes constitutes a *nominal* or *classificatory* scale. Each class may be represented by a letter, a name, a number, or some other symbol. The only relation which holds in the nominal scale is the relation of equivalence, which holds between entities in the same class. We use nominal scaling in identifying the fields of scholarly endeavor: we assign a scholar to a class in a nominal scale when we say he is a "physicist," "linguist," "biochemist," or "historian." Often numbers are used as the symbols in nominal scaling. The numbers on automobile plates and postal zone numbers are examples.

When the objects in the various classes of a scale stand in some kind of relation to one another, the scale is an *ordinal* or *ranking* scale. The fundamental difference between a nominal and an ordinal scale is that the ordinal scale incorporates not only the relation of equivalence ($=$) but also the relation "greater than" ($>$). Given a group of equivalence classes, if the relation $>$ holds between some but not all pairs of classes, we have a partially ordered scale. If the relation $>$ holds for all pairs of classes so that a complete rank ordering of classes arises, we have an ordinal scale. In the academic world, professorial positions stand in an ordinal relation to one another: professor $>$ associate professor $>$ assistant professor $>$ instructor. The use of numbers to represent an ordinal relation is illustrated by Civil Service job classifications (GS12 $>$ GS11 $>$ GS10) and by street addresses.

When the distances between any two classes on a scale are known numerically, the classes fall on an *interval* scale. An interval scale has all the characteristics of an ordinal scale, and in addition has a common and constant unit of measurement which assigns a real number to all pairs of objects in the ordered set. On an interval scale, the ratio of any two intervals is independent of the unit of measurement and of the zero point, both of which are arbitrary. Our two scales to measure temperature, the Fahrenheit and centigrade scales, are both examples of interval scales.

When a scale has all the characteristics of an interval scale and in addition has a true zero point as its origin, it is called a *ratio* scale. On a ratio scale, the ratio of any two scale points is independent of the unit of measurement. We measure mass or weight in a ratio scale. The scale of ounces and pounds has a true zero point, as does the scale of grams. The ratio between any two weights is independent of the unit of measurement. For example, if we should determine the weights of two different objects not only in pounds but also in grams, we would find that the ratio of the two pound weights would be identical to the ratio of the two gram weights.

Permissible operations and appropriate statistics. The purpose of the preceding discussion of levels of measurement is to remind the reader that at different times we use typographically identical numbers to represent observations and coding procedures of widely varying strengths. The manipulations which may meaningfully be performed on a set of numbers depend on the strength of measurement which the numbers represent. It is clear, for example, that while it is certainly meaningful to add two weights (when we combine the contents of a two-pound box of candy with the contents of a one-pound box we will indeed have three pounds of candy), there is no comparable simple or useful meaning to the sum of two automobile license numbers or the sum of two street addresses.

Each of the four levels of measurement has certain appropriate manipulations associated with it. In order to be able to make certain operations with numbers that have been assigned to operations, the structure of our method of mapping numbers (assigning scores) must be *isomorphic* to some numerical structure which includes these operations. If two systems are isomorphic, their structures are the same in the relations and operations they allow.

In a *nominal* scale, the information may be equally well represented by any set of symbols, as long as the

equivalence relation is preserved. That is, *the nominal scale is unique up to a one-to-one transformation:* the symbols designating the various classes in the scale may be changed or even exchanged, if this is done consistently and completely. Thus, a postal area may be rezoned, with blocks formerly in zone 5 now falling in zone 12, and those formerly in zone 8 now falling in zone 5, etc., and no information will be lost in the rezoning if it is accomplished consistently and throughly. With nominal data, the meaningful statistics are those whose information would be unchanged by a one-to-one transformation: frequency counts, the mode, etc. Under certain conditions, we can test hypotheses regarding the distribution of cases among classes by using statistical tests which use frequencies in unordered categories, i.e., enumerative data. The χ^2 tests are of this type. The most common measure of association for classificatory data is the contingency coefficient. All of these are nonparametric statistics.

The information in an *ordinal* scale may be equally well represented by any ordered set of symbols. That is, *the ordinal scale is unique up to a monotonic transformation*—any order-preserving transformation does not diminish the information it encodes. At present, a corporal wears two stripes and a sergeant wears three. These insignia denote that sergeant $>$ corporal. This relation would be as well expressed if the corporal wore four stripes and sergeant wore seven. The statistic most appropriate for describing the central tendency of scores in an ordinal scale is the median, for the median is not affected by changes of any scores which are above or below it as long as the number of scores above and below remains the same. With ordinal data, hypotheses can be tested by using that large group of nonparametric statistical tests which are sometimes called "order tests" or "ranking tests." Correlation coefficients based on rankings, e.g., those of Spearman and Kendall, are appropriate.

Some ranking tests assume that there is a continuum underlying the observed ranks. Such an assumption is frequently quite tenable even though the grossness of our measuring devices obscures the underlying continuity. For example, although we may classify college students at the end of their college careers in only three ranks—graduating with honors, graduating, and failing to graduate—underlying this ranking is a continuum of achievement in college. Data based on such a ranking could appropriately be subjected to a test which carried the assumption of underlying continuity.

If a variate is truly continuously distributed, then the probability of a tie between two observations is zero. However, tied ranks and tied scores frequently occur in research data. Tied scores are almost invariably a reflection of the lack of sensitivity of our measuring instruments, which fail to distinguish small differences which in fact do exist between the tied observations—they "exist" in the sense that a more sensitive measuring instrument would distinguish them. Therefore, even when ties are observed it may not be unreasonable to assume that a continuous distribution underlies the observations. Most nonparametric techniques incorporate a correction for tied observations.

In the case of an *interval* scale, any change in the numbers associated with the positions of the objects on the scale must preserve not only the ordering of the objects but also the relative differences between them. That is, *an interval scale is unique up to a linear transformation.* For example, although for a given heat the readings on our two temperature scales, centigrade and Fahrenheit, would differ, both scales contain the same amount and the same kind of information—they are linearly related. Although the two scales have a different zero point and a different unit of measurement, a reading on one scale can be transformed to the equivalent reading on the other by the linear transformation $F = 9/5\ C + 32$, where $F =$ number of degrees on the Fahrenheit scale and $C =$ number of degrees on the centigrade scale. It can be shown that the ratios of temperature differences (intervals) are independent of the unit of measurement and of the zero point. Some readings of the same heat on the two scales are:

Centigrade	0	10	30	100
Fahrenheit	32	50	86	212

Notice that the ratio of the differences between temperature readings on one scale is equal to the ratio between the equivalent differences on the other scale. For example, on the centigrade scale the ratio of the differences between 30 and 10, and 10 and 0, is $30 - 10/10 - 0 = 2$. For the comparable readings on the Fahrenheit scale, the ratio is $86 - 50/50 - 32 = 2$.

The interval scale is a quantitative (numerical) scale and statistics which are obtained by treating scores as numbers (such as the mean, the standard deviation, the Pearson product-moment correlation coefficient, etc.) may appropriately be used to represent data based on interval scaling. Most parametric statistical tests, including the t and F tests, are applicable to such data.

A ratio scale is unique up to multiplication by a positive constant. That is, the ratios between any two numerical observations on the scale are preserved when the scale values are all multiplied by a positive constant, and thus such a transformation does not alter the information encoded in the scale. Any statistical test is usable when ratio measurement has been achieved. In addition to those statistics previously mentioned as being appropriate for data in an interval scale, with a ratio scale one may meaningfully use such statistics as the geometric mean and the coefficient of variation—

Table 1—Four Levels of Measurement and the Statistics Appropriate to Each Level

Scale	Defining Relations	Examples of Appropriate Statistics	Appropriate Statistical Tests
Nominal	(1) Equivalence	Mode Frequency Contingency coefficient	Nonparametric statistical tests
Ordinal	(1) Equivalence (2) Order	Median Percentile Spearman r_s Kendall τ Kendall W	
Interval	(1) Equivalence (2) Order (3) Ratio of intervals	Mean Standard deviation Pearson product-moment correlation Multiple product-moment correlation	Nonparametric and parametric statistical tests
Ratio	(1) Equivalence (2) Order (3) Ratio of intervals (4) Ratio of values	Geometric mean Coefficient of variation	

statistics which require knowledge of the true zero point.

Table 1 summarizes the discussion which has been presented concerning the relation between the strength of measurement represented by the data and the statistics and statistical tests which are appropriate. Of course this presumes that the assumptions of the tests' statistical models are satisfied.

Power-Efficiency

The researcher may find that the test which suits the level of measurement he has achieved and whose statistical model is appropriate to the conditions of his research is not the most powerful test available. Confronted by the dilemma posed by the contradictory outcomes of the criteria of power and appropriateness, the researcher may resolve the conflict by choosing the more appropriate test and then enlarging his sample in order to increase the power of that test. The assertion that a test with greater generality is usually weaker in the test of H_0 than is a test restricted by many assumptions is generally true for any given sample size. But it may very well not be true in a comparison of two statistical tests which are applied to two samples of unequal size. That is, with samples of say 30, test A may be more powerful than test B. But test B may be more powerful with a sample of 30 than test A is with a sample of 20.

The concept of *power-efficiency* is concerned with the amount of increase in sample size which is necessary to make test B as powerful as is test A with a given sample size. If test A is the most powerful known test of its type (when used with data which meet the conditions of its statistical model) and if test B is another test suitable for the same research design which is just as powerful with N_b cases as test A is with N_a cases, then

$$\text{Power-efficiency of test B} = 100 \frac{N_a}{N_b} \text{ per cent}$$

For example, if test B requires a sample of $N_b = 30$ cases to have the same power that test A has with $N_a = 27$ cases, then test B has power-efficiency of (100) 27/30 percent, i.e., its power-efficiency is 90 per cent. This means that in order to equate the power of test A with the power of test B (when all the conditions of both tests are met by the data, and when test A is the more powerful), we need to draw 10 cases for test B for every 9 cases drawn for test A.

Relative to the *t* and *F* test, the nonparametric tests suitable for testing hypotheses analogous to those tested by the *t* and *F* tests vary in power-efficiency from 63 percent to 100 per cent. The weaker ones are the tests which use classificatory data—for example, if scores suitable for treatment by the *t* test were split at their

median and tested for differences in location by the median test, the power-efficiency of that test would be about 63 per cent. Many tests which use ranked data have power-efficiency around 95 per cent. The randomization tests, which are used when the scores have numerical meaning, have 100 per cent power-efficiency.

In considering these values, the reader is cautioned to remember that they compare the power of parametric and nonparametric tests *when used with data for which the parametric tests are appropriate*, i.e., when used with data which meet the assumptions and requirements of the statistical model for parametric tests. That is, when we say, for example, that the Mann-Whitney test has power-efficiency of about 95 per cent, we mean that when the Mann-Whitney test is used on two samples of scores which were independently drawn, from normally distributed populations of equal variance, then with $N = 40$ it will reject H_0 at the same level of significance that the t test will with $N = 38$. But if the two tests were both used with data from non-normal populations or with data from populations differing in variance, the Mann-Whitney test might very well reject H_0 at a more stringent significance level than would a t test. Whitney (14) has shown that for some population distributions a nonparametric statistical test is clearly superior in power to a parametric one. With such data, we must rely on the inference based on the nonparametric test, for with such data a t test is inappropriate and therefore yields less meaningful results.

Advantages of Nonparametric Tests

At present, for a great many research designs, both parametric and nonparametric statistical tests are available. We have suggested that the choice between the alternative tests suitable for a given research design should be based on three criteria: (a) the applicability of the statistical models on which the tests are based to the data of the research, (b) the level of measurement achieved in the research, and (c) the power-efficiency of each alternative test. In terms of these criteria, nonparametric tests have certain merits. The enumeration of these may serve as a summary of the arguments presented above, and will introduce certain additional considerations as well.

1. Probability statements obtained from most nonparametric statistical tests are *exact* probabilities (except in the case of large samples, for which excellent approximations are available), regardless of the shape of the population distribution from which the random sample was drawn. That is, a conclusion based on a nonparametric test does not carry stringent qualifiers, as does a conclusion based on a parametric test.

2. If samples as small as 6 are used, there is no alternative to using a nonparametric statistical test unless the nature of the population distribution is known exactly. This is an advantage in pilot testing and in research with populations whose nature precludes the use of large samples (e.g., populations of persons having a rare form of illness).

3. There are suitable nonparametric statistical tests for treating samples made up of observations from several different populations. None of the parametric tests can handle such data unless seemingly unrealistic assumptions are made.

4. Nonparametric statistical tests are available to treat data which are inherently in ranks as well as scores which have merely the strength of ranks. In many fields of investigation, ordinal measurement is the strongest that usually can be achieved. This is the case, for example, in the behavioral sciences. Such data, as well as those for which only gross ordering (plus or minus, for example) can be achieved, can be treated by nonparametric methods, whereas they cannot be treated by parametric methods unless precarious, untestable, and perhaps unrealistic assumptions are made about the underlying distributions.

5. Nonparametric methods are available to treat classificatory data. No parametric technique applies to such data.

6. Nonparametric statistical tests are typically much easier to learn and to apply than are parametric tests.

The advantage which parametric tests hold over their nonparametric counterpart is, of course, that if all the assumptions of the parametric statistical model are in fact met in the research and if the measurement is of the required strength, then nonparametric statistical tests are wasteful of data. The degree of wastefulness in such cases is expressed by the power-efficiency of the nonparametric tests.

Table 2 indicates the variety of nonparametric tests which are now available, and shows the research design and the level of measurement for which each is useful. This list is by no means exhaustive, but an attempt has been made to include a diversity of tests and measures of association and to include those which are most commonly used.

To save space, citations for all tests are not given in this article. In most cases, Table 2 gives the names of the authors of the tests, and the reader may turn to (9) or (10) for references for these tests. The randomization tests were originated by Fisher; early work on their development was presented by Pitman and Welch, and more recently Kempthorne (4, 5) has made important contributions to them. Included in Table 2 are citations for the two most recent tests.

The inclusion of several tests in the same category in Table 2 does not imply that the several tests are equivalent or interchangeable. For example, five tests are listed for use with k independent samples when ordinal

Table 2—Nonparametric Statistical Tests and Measures of Correlation for Various Designs and Various Levels of Measurement

LEVEL OF MEASUREMENT	NONPARAMETRIC STATISTICAL TEST					NONPARAMETRIC MEASURE OF CORRELATION
		Two-Sample Case		*k*-Sample Case		
	One-Sample Case	Related Samples	Independent Samples	Related Samples or Randomized Blocks	Independent Samples	
Nominal	Binomial test χ^2 test	McNemar test	Fisher exact probability test χ^2 test	Bowker test Cochran Q test	χ^2 test	Contingency coefficient
Ordinal	Kolmogorov-Smirnov test Runs test	Sign test Wilcoxon test	Festinger test Kolmogorov-Smirnov test Mann-Whitney U test Median test Moses test of extreme reactions Wald-Wolfowitz runs test White test Wilcoxon test	Friedman test Wilson test (15)	Extension of the median test Jonckheere test Kruskal-Wallis test Mood runs test Mosteller slippage test Whitney extension of the U test	Cureton biserial rank correlation (1) Kendall rank correlation coefficient Kendall partial rank correlation coefficient Kendall coefficient of concordance Moran multiple rank correlation Spearman rank correlation coefficient
Interval	Walsh test Randomization test	Walsh test Randomization test	Randomization test	Randomization test	Randomization test	Olmstead-Tukey corner test Randomization test

measurement has been achieved. Each of these has a different application. The extension of the median test is useful when only incomplete ordering has been achieved, so that any observation may be classed either above or below the common median. The Kruskal-Wallis test is a more general test for data in which complete ordering has been achieved, and thus it is more powerful than the extension of the median test. Whitney's extension of the U test is not an analogue of the analysis of variance, as is the Kruskal-Wallis test, being a significance test for only three samples which tests the prediction that the three averages will occur in a specific order. The Jonckheere test is a test against ordered alternatives; the Mosteller technique tests whether one group has slipped significantly to the right of the others; and the k-sample runs test is sensitive to any sorts of differences among groups, not just differences in location.

REFERENCES

1. Cureton, E. E., "Rank-Biserial Correlation," *Psychometrika*, 1956, 21, 287-290.
2. Dixon, W. J., and Massey, F. J., *Introduction to Statistical Analysis*. (2nd Ed.) New York: McGraw-Hill, 1957.
3. Fraser, D. A. S., *Nonparametric Methods in Statistics*. New York: Wiley, 1957.
4. Kempthorne, O., *The Design and Analysis of Experiments*. New York: Wiley, 1952.
5. Kempthorne, O., "The Randomization Theory of Experimental Inference," *J. Amer. Statist. Assn.*, 1955, 50, 946-967.
6. Mood, A. M., *Introduction to the Theory of Statistics*. New York: McGraw-Hill, 1950.
7. Moses, L. W., "Non-Parametric Statistics for Psychological Research," *Psychol. Bull.*, 1952, 49, 122-143.
8. Mosteller, F., and Bush, R. R. "Selected Quantitative Techniques." In G. Lindzey (Ed.) *Handbook of Social Psychology*. Vol. 1. *Theory and Method*. Cambridge, Mass.: Addison-Wesley, 1954. Pp. 289-334.
9. Savage, I. R., "Bibliography of Nonparametric Statistics and Related Topics," *J. Amer. Statist. Assn.*, 1953, 48, 844-906.
10. Siegel, S., *Nonparametric Statistics: For the Behavioral Sciences*. New York: McGraw-Hill, 1956.
11. Smith, K., "Distribution-Free Statistical Methods and the Concept of Power Efficiency." In L. Festinger and D. Katz (Eds.), *Research Methods in the Behavioral Sciences*. New York: Dryden, 1953. Pp. 536-577.
12. Stevens, S. S., "On the Theory of Scales of Measurement," *Science*, 1946, 103, 677-680.
13. Tukey, J. W. *The Simplest Signed-Rank Tests*. Mimeographed Report No. 17, Statistical Research Group, Princeton University, 1949.
14. Whitney, D. R. "A Comparison of the Power of Non-Parametric Tests and Tests Based on the Normal Distribution under Non-Normal Alternatives.' Unpublished doctor's dissertation, Ohio State University, 1948.
15. Wilson, K. V., "A Distribution-Free Test of Analysis of Variance Hypotheses," *Psychol. Bull.*, 1956, 53, 96-101.

Program of the 117th Annual Meeting of the

American Statistical Association

Ambassador Hotel, Atlantic City, September 10-13, 1957

Combined with the program of the INSTITUTE OF MATHEMATICAL STATISTICS and the BIOMETRIC SOCIETY (ENAR), with whom the Association is meeting jointly.

Schedule of Meetings

Note: The program is as accurate as possible at the time this issue went to press. However, please remember that changes will occur in times as well as content before the meeting takes place. The version below is for information only; consult the final program for actual schedules.

TUESDAY, SEPTEMBER 10

10:00-11:30 A.M.

Session of Mixed Topics

Institute of Mathematical Statistics

Chairman:

(To be announced)

Papers:

"Some Remarks on Statistical Inference" by HERBERT ROBBINS, Columbia University

(Others to be announced)

10:00 A.M.-12:00 Noon

Methodology of Response Surface Exploration

Section on Physical and Engineering Sciences—Biometric Section—Biometric Society (ENAR)

Chairman:

VIRGIL ANDERSON, Purdue University

Paper:

"Some Considerations Arising in the Exploration and Exploitation of Response Surfaces" by J. STUART HUNTER, American Cyanamid Company

Discussion:

OSCAR KEMPTHORNE, Iowa State College

G. E. P. BOX, Princeton University

10:00 A.M.-12:00 Noon

Objective Methods in Forecasting Crop Yields

Biometric Section—Biometric Society (ENAR)

Chairman:

WALTER A. HENDRICKS, Department of Agriculture

Papers:

"Crop Forecasts in the Framework of Statistical Decision Theory" by GEORGE M. KUZNETS, University of California; and YAIR MUNDLAK, Hebrew University, Israel

"Use of Observed Plant Characteristics in Crop Forecasting" by HAROLD F. HUDDLESTON, Department of Agriculture

"Forecasting Filbert Production from Counts of Nuts Set and Weights of Nuts" by ROBERT PARR, Oregon Crop Reporting Service; and LYLE CALVIN, Oregon Agricultural Experiment Station

Discussion:

W. P. LANIER, Buckeye Cellulose Corporation

BRUCE W. KELLY, Department of Agriculture

10:00 A.M.-12:00 Noon

How to Communicate Statistical Findings to Management

Business and Economic Statistics Section

Chairman:

WILLIAM F. BUTLER, The Chase Manhattan Bank

Papers:

"Presentation of Statistics to the Management of a Large Chemical Company" by IRA T. ELLIS, E. I. du Pont de Nemours & Co.

"How Management is Kept Informed on Production Statistics and Market Conditions" by STAHRL EDMUNDS, Ford Motor Co.

"How an Economic Consultant Organization Prepares Presentations for Clients" by HENRY BUND, Research Institute of America

"How Results of Statistical and Economic Research are Presented to the Board of Governors of the Federal Reserve System" by FRANK R. GARFIELD, Federal Reserve Board

"How the Results of Research in the Field of International Markets are Transmitted to Management" by JACK SUNDELSON, Ford Motor Co.

10:00 A.M.-12:00 P.M.

Developments in Regional Analysis

Business and Economic Statistics Section

Chairman:

FRANK A. HANNA, Duke University

Papers:

"Regional Aspects of Cyclical Fluctuations" by GEORGE H. BORTS, Brown University

"A Concept of 'Region' in the Study of Economic Growth" by KENNETH BUCKLEY, National Bureau of Economic Research, Inc.

"Industrial Growth and Diversification in Metropolitan Areas" by ROBERT M. LICHTENBERG, N. Y. Metropolitan Region Study

Discussion:

(To be announced)

11:30 A.M.-12:30 P.M.

Wald Lecture—I

Institute of Mathematical Statistics

Chairman:

THEODORE E. HARRIS, Rand Corp.

Paper:

"Polya-Type Theory" by SAMUEL KARLIN, Stanford University

12:00 Noon—Luncheon

Stock Market Forecast for 1957-58

General Session, ASA—Business and Economic Statistics Section

Chairman:

EDWARD WILSON, Hallgarten & Co.

Speakers:

"Outlook for Stock Prices" by NICHOLAS CRANE, Dean Witter & Co.

"Principles of Investing" by HAROLD M. DORSEY, Argus Research Co.

"The Yield Spread and Its Statistical Indicators" by J. EUGENE BANKS, Brown Brothers, Harriman & Co.

2:00-3:30 P.M.

Rietz Lecture

Institute of Mathematical Statistics

Chairman:

JERZY NEYMAN, University of California, Berkeley

Paper:

"The Coding of Messages Subject to Chance Errors" by J. WOLFOWITZ, Cornell University

2:00-4:00 P.M.

Applications of Response Surface Designs

Section on Physical and Engineering Sciences—Biometric Section—Biometric Society (ENAR)

Chairman:

DONALD A. GARDINER, Oak Ridge National Laboratory

Papers:

"Use of Response Surface Techniques" by ROBERT M. DEBAUN, American Cyanamid Co.

(Other papers to be announced)

Discussion:

CUTHBERT DANIEL, Private Consultant

2:00-4:00 P.M.

Urban Renewal

Social Statistics Section

Chairman:

HUGH R. POMEROY, Westchester County Dept. of Planning, N. Y.

Paper:

"Statistical Problems in Urban Renewal" by BENJAMIN LIPSTEIN, Audits and Surveys Co.; CHESTER RAPKIN, University of Pennsylvania; A. H. SCHAAF, University of California

Discussion:

(To be announced)

2:00-4:00 P.M.

Current Statistical Problems at Agricultural Experiment Stations

Section on Training

Chairman:

HENRY TUCKER, University of Arizona

Papers:

"Field Experiments" by DAVE MASON, North Carolina State College

"Animal Experiments" by PAUL HOMEYER, Iowa State College

"Laboratory and Greenhouse Experiments" by CARL MARSHALL, Oklahoma A. and M. College

2:00-4:00 P.M.

Problems of Seasonal Measurement

Business and Economic Statistics Section

Chairman:

W. DUANE EVANS, Bureau of Labor Statistics

Papers:

"Problems of Seasonality in Price Data" by H. E. RILEY, Bureau of Labor Statistics

"Seasonal Adjustments of Economic Indicators" by JULIUS SHISKIN, Bureau of the Census

Discussion:

RALPH E. BURGESS, American Cyanamid Co.

RICHARD J. FOOTE, Dept. of Agriculture

2:00-4:00 P.M.

Contributed Papers

General Session, ASA

Chairman:

BENJAMIN J. TEPPING, National Analysts, Inc.

Papers:

"Graphic Methods Based Upon Properties of Advancing Centroids" by S. I. ASKOVITZ, University of Pennsylvania

"A Model for Failure Data: Estimation Problem" by ANDRE G. LAURENT, Michigan State University

"Automatic Programming as a Means of Enabling Statistical Applications of Computers" by MITCHELL O. LOCKS, Sperry Rand Corp.

"Median Age at First Marriage in the United States" by EMANUEL LANDAU, California Department of Health and PATIENCE LAURIAT, Bureau of the Census'

"Soviet Population Census of December 17, 1926; Procedure, Methods, Concepts" by GALENA V. SELEGEN, Washington, D. C.

3:30-6:00 P.M.

Multiple Decision Selection Procedures

Institute of Mathematical Statistics

Chairman:

WILLIAM G. COCHRAN, The Johns Hopkins University

Papers:

"A Sequential Multiple Decision Procedure for Selecting the Best One of Several Normal Populations with a Common Unknown Variance and Its Use with Various Experimental Designs" by ROBERT E. BECHHOFER, Cornell University

"Multiple Decision Procedures for Selecting that Multinomial Event Which Has the Largest Probability" by SALAH ELMAGHRABY and NORMAN MORSE, Cornell University

"A Parametric Approach to the Problem of Selecting a Subset Containing the Best Population" by SHANTI S. GUPTA, Bell Telephone Laboratories

"A Non-parametric Approach to the Problem of Selecting a Subset Containing the Best Population" by MILTON SOBEL, Bell Telephone Laboratories

4:00-6:00 P.M.

Factors Influencing Inventory Changes

Business and Economic Statistics Section

Chairman:

RUTH P. MACK, National Bureau of Economic Research, Inc.

Papers:

"Bank Credit and Inventory Cycles" by DORIS EISEMANN, Rand Corp.

"The Behavior of Manufacturers' Inventories Since World War II" by THOMAS STANBACK, JR., New York University

Discussion:

JOHN D. WILSON, Chase Manhattan Bank

LAWRENCE BRIDGE, Dept. of Commerce

MOSES ABRAMOVITZ, Stanford University

4:00-6:00 P.M.

Consumer Expenditure Estimates for Food and Their Uses

Business and Economic Statistics Section

Chairman:

(To be announced)

Papers:

"Income Food Relationships from Time Series and Cross Section Surveys" by MARGUERITE BURK, Dept. of Agriculture

"A New Type of Estimate of the Income Elasticity for Food" by JEAN CROCKETT, University of Pennsylvania

Discussion:

(To be announced)

4:00-6:00 P.M.

Income Distribution and Sub-Standard Levels of Living

Social Statistics Section—Business and Economic Statistics Section

Chairman:

(To be announced)

Papers:

"Basic Concepts" by MEREDITH B. GIVENS, Interdepartmental Committee on Low Incomes of New York State and WILBUR C. COHEN, University of Michigan

"Methods of Inquiry—The Income Approach" by DANIEL CREAMER, Interdepartmental Committee on Low Incomes of New York State

"Methods of Inquiry—The Consumption Approach" by ELEANOR M. SNYDER, Interdepartmental Committee on Low Incomes of New York State

Discussion:

(To be announced)

4:00-6:00 P.M.

Use of Stochastic Processes in Biology

Biometric Section—Biometric Society (ENAR)—Institute of Mathematical Statistics

Chairman:

PAUL MEIER, The Johns Hopkins University

Papers:

"The Role of Variable Generation Time in Tissue Cell Multiplication" by JOSEPH G. HUFFMAN, Roswell Park Memorial Institute

"Application of a Stochastic Model of Contagion to Data from a Foundling Home" by EVELYN FIX, University of California

"Analysis of Replicate Experiments on the Survival of Bacteria in Sea Water" by EUGENE K. HARRIS, Public Health Service

8:00-10:00 P.M.

Some New Factors in the Long-Run Economic Outlook

Business and Economic Statistics Section

Chairman:

H. W. STEINHAUS, New York City

Papers:

"The Implications of Pension Fund Accumulations" by VITO NATRELLA, Securities and Exchange Commission

"The Implications of the Changing Ownership of Federal Securities" by IRA SCOTT, University of Minnesota

"The Implications of the Highway Program as an Important Factor in the Long-Run Economic Outlook" by JAY ATKINSON, Dept. of Commerce

"Technology and Population as Factors in the Long-Run Economic Outlook" by IRVING H. SIEGEL, Council of Economic Advisers

8:00-10:00 P.M.

Institute of Mathematical Statistics—1957 Council Meeting

President: A. M. Mood, General Analysis Corp.

WEDNESDAY, SEPTEMBER 11

8:00 A.M.—Breakfast

Meeting of Chapter Presidents and Secretaries and District Representatives

American Statistical Association

8:30-10:30 A.M.

Application of Statistical Theory to Computers

General Session, ASA — Institute of Mathematical Statistics

Chairman:

(To be announced)

Papers:

"Some Probability Considerations in the Estimation of Computer Running Time" by ELI S. MARKS and BENJAMIN J. TEPPING, National Analysts, Inc.

"A Model for Univac Operations" by LEON GILFORD, Bureau of the Census

8:30-10:30 A.M.

Developments in Methods for Short-Term Forecasting—I: A Review of National Bureau of Economic Research Lead Indicators and Other Diffusion Indexes

Business and Economic Statistics Section

Chairman:

GEORGE GARVY, Federal Reserve Bank of New York

Papers:

"The Economic and Statistical Logic of Diffusion Indexes" by ALBERT SOMMERS, National Industrial Conference Board

"The Predictive Value of Diffusion Indexes" by FRANK E. MORRIS, Investment Bankers Association of America

"An Experiment with Weighted Indexes of Cyclical Diffusion" by BERT G. HICKMAN, The Brookings Institution

Discussion:

FRANK GARFIELD, Federal Reserve Board

STANLEY LEBERGOTT, Office of Statistical Standards

8:30-10:30 A.M.

Genetic Statistics

Biometric Section—Biometric Society (ENAR)

Chairman:

E. L. LECLERG, Dept. of Agriculture

Papers:

"Estimation of Genetic Progress in Each of n Traits" by W. R. HARVEY, Dept. of Agriculture

"Models for Quantitative Gene Effects" by D. S. ROBSON, Cornell University

"The Estimation of Environmental and Genetic Trends from Selected Data" by O. KEMPTHORNE, Iowa State College

8:30-10:30 A.M.

Subject Matter Covered in University Programs of Engineering Statistics

Section on Training—Section on Physical and Engineering Sciences

Chairman:

BOYD HARSHBARGER, Virginia Polytechnic Institute

Speakers:

R. J. HADER, North Carolina State College

I. W. BURR, Purdue University

R. L. WINE, Hollins College

D. V. HUNTSBERGER, Iowa State College

R. E. BECHHOFER, Cornell University

9:00-11:30 A.M.

Stochastic Processes

Institute of Mathematical Statistics

Chairman:

H. B. MANN, Ohio State University

Papers:

"The Identifiability Problem for Functions of Finite Markov Chains" by DAVID BLACKWELL, University of California, Berkeley

"Cosmic Ray Cascade Processes" by THEODORE E. HARRIS, The Rand Corp.

"Some Problems in Applied Stochastic Processes from the Point of View of Semi-group Theory" by A. T. BHARUCHA-REID, University of Oregon

"On Testing the Markov Property" by P. BILLINGSLEY, Princeton University

10:30 A.M.-12:30 P.M.

Developments in Methods for Short-Term Forecasting—II: Correlation Techniques and Anticipatory Data

Business and Economic Statistics Section

Chairman:

ROBERT FERBER, University of Illinois

Papers:

"Anticipations Data in the Capital Goods Field" by by MORRIS COHEN, National Industrial Conference Board, Inc.

"Procedures That Are Useful in Judging Whether Analyses Will Apply in Future Periods" by RICHARD J. FOOTE, Dept. of Agriculture

Discussion:

(To be announced)

10:30 A.M.-12:30 P.M.

Methodology of Fractional Replication

Section on Physical and Engineering Sciences—Biometric Section—Biometric Society (ENAR)

Chairman:

(To be announced)

Paper:

"Fractional Factorials and Confounding" by R. L. ANDERSON, North Carolina State College

Discussion:

OSCAR KEMPTHORNE, Iowa State College
G. E. P. BOX, Princeton University

10:30 A.M.-12:30 P.M.

Appraisal of University Programs by Industrial Representatives

Section on Training—Section on Physical and Engineering Sciences

Chairman:

W. H. HORTON, Westinghouse Electric Co.

Speakers:

S. M. FREE, Smith, Kline and French Laboratories
JOHN HROMI, United States Steel Corp.
MILTON TERRY, Bell Telephone Laboratories
J. H. DAVIDSON, General Electric Corp.
W. J. YOUDEN, National Bureau of Standards

10:30 A.M.-12:30 P.M.

Youth Work Experience

Social Statistics Section

Chairman:

SEYMOUR L. WOLFBEIN, Bureau of Labor Statistics

Papers:

"The Office of Education Reports on Its Cooperative Study of School Drop-Outs in Twenty Large Cities" by DAVID SEGEL, Office of Education

"School-Leavers in the World of Work" by MARGARET L. PLUNKETT, Bureau of Labor Statistics

Discussion:

MARK MCCLOSKEY, New York State Youth Commission
HARLEY ALLEN, Assistant Superintendent of Schools, Caldwell, New Jersey
ERWIN L. MALONE, Rice and Malone

11:30 A.M.-12:30 P.M.

Wald Lecture—II

Institute of Mathematical Statistics

Chairman:

WILLIAM G. MADOW, Stanford Research Institute

Paper:

"Polya-Type Theory" by SAMUEL KARLIN, Stanford University

12:00 Noon—Luncheon

The Economic Outlook

Business and Economic Statistics Section

Chairman:

MARTIN R. GAINSBRUGH, National Industrial Conference Board, Inc.

Speakers:

(To be announced)

2:00-3:30 P.M.

Special Invited Paper

Institute of Mathematical Statistics

Chairman:

LEO KATZ, Michigan State University

Paper:

"Asymptotic Approximations to Distributions" by DAVID L. WALLACE, University of Chicago

2:00-4:00 P.M.

Some Classification Problems in Sociology and Psychology

Social Statistics Section—Institute of Mathematical Statistics

Chairman:

HERBERT SOLOMON, Columbia University

Papers:

"Classification by Configuration and Level" by E. I. BURDOCH, New York Department of Mental Hygiene

"Application of Analysis of Variance Techniques to Profile Analysis" by S. W. GREENHOUSE and S. GEISSER, National Institute of Mental Health

"Classification by Response Vectors Based on n Dichotomous Items" by ROSEDITH SITGREAVES, Columbia University

Discussion:

(To be announced)

2:00-4:00 P.M.

Tolerance Limits

Biometric Section—Biometric Society (ENAR)—Section on Physical and Engineering Sciences

Chairman:

SUTTON MUNRO, Bell Telephone Laboratories

Papers:

"Approximate Distribution—Free Properties of $\bar{X} \pm ks$ Tolerance Interval" by J. E. WALSH, Lockheed Aircraft Corp.

"Sequential Distribution—Free Tolerance Limits" by S. C. SAUNDERS, Boeing Airplane Co.

"Estimation of Some Tolerance Limits from Censored Data" by E. A. THOMAS, Avco Research and Advanced Development

"Determination of Tolerance Limits through Experimentation" by ALFRED LIEBERMAN, Dept. of the Navy.

2:00-4:00 P.M.

National Long-Term Economic Projections—I: Labor Force and Rate of Utilization

Business and Economic Statistics Section

Chairman:

CHARLES D. STEWART, Dept. of Labor

Papers:

"Some New Dimensions in Labor Force Projections" by SOPHIA COOPER, Bureau of Labor Statistics

"Trends in Work Week—Implications for Economic Projections" by JOSEPH ZEISEL, Bureau of Labor Statistics

Discussion:

(To be announced)

2:00-4:00 P.M.

Concentration in Manufacturing Industry

Business and Economic Statistics Section

Chairman:

A. D. H. KAPLAN, The Brookings Institution

Papers:

"New Statistics on Companies and on Concentration in Manufacturing From the 1954 Census" by IRVING ROTTENBERG, Bureau of the Census

"An Appraisal of the 1954 Census Tabulations Relating to Concentration in Manufacturing Industries" by MORRIS A. ADELMAN, Massachusetts Institute of Technology

Discussion:

JESSE FRIEDMAN, Consulting Economist

DANIEL C. HAMILTON, Atlantic Refining Co.

3:30-5:30 P.M.

Regression Models and Multifactor Designs

Institute of Mathematical Statistics

Chairman:

CHURCHILL EISENHART, National Bureau of Standards

Papers:

"Some Mathematical Problems Arising in the Construction of Fractionally Replicated Designs and Designs for the Study of Response Surfaces" by R. C. BOSE, University of North Carolina

"Reduced Regression Models" by MARTIN WILK, Princeton University

4:00-6:00 P.M.

Testing Hypotheses in Evaluating Social Welfare Programs

Social Statistics Section

Chairman:

FREDERICK STEPHAN, Princeton University

Papers:

"An Experiment to Measure the Effectiveness and Costs of the Health and Welfare Program for Aging Persons" by JULIUS JAHN, Community Service Society of New York

"Testing Hypotheses in Evaluating Social Welfare Programs" by ROBERT BUSH, New York School of Social Work

"Measurement of Costs in a Child Welfare Institution" by MARTIN WOLINA, New York School of Social Work

"Evaluating Case History Data at Time of Admission to a Juvenile Training Institution" by MANZER GRISWOLD and PAUL MUELLER, Dept. of Institutions, State of Washington

Discussion:

EDWARD SCHWARTZ, New York University

LEONARD KOGAN, Community Service Society of New York

EDWARD B. OLDS, Baltimore Council of Social Welfare

4:00-6:00 P.M.

Revision of Industrial Classification

Business and Economic Statistics Section

Chairman:

V. S. KOLESNIKOFF, Office of Statistical Standards

Papers:

"Revised Standard Industrial Classification" by FRANK A. CISAR, Office of Statistical Standards

"The Role of Industrial Classification in State Employment Security Programs" by LOUIS LEVINE, Dept. of Labor

"Use of Standard Industrial Classification in Market Research" (Speaker to be announced)

Discussion:

(To be announced)

4:00-6:00 P.M.

Methods of Estimating Retail and Consumer Inventories

Business and Economic Statistics Section

Chairman:

ARTHUR ROSENBAUM, Sears Roebuck and Co.

Papers:

"Inventory Planning as a Part of Business Expectational Data" by ORIN BURLEY, University of Pennsylvania

"A New Approach to the Estimation of Inventories" by RALPH S. WOODRUFF. Bureau of the Census
"Food Chain Inventories" by H. R. POWELL, Jewel Tea Company, Inc.
"General Merchandise Inventories—Appraisal of Data and Use in Leveling of Business Cycle" by MYRON S. SILBERT, Federated Department Stores, Inc.
"Methods of Estimating Retail and Consumer Inventories of Passenger Cars" by W. C. FLAHERTY, Chrysler Corp.

4:00 P.M.

Section on Training—Business Meeting

4:00 P.M.

Biometric Section—Business Meeting

5:30 P.M.

Institute of Mathematical Statistics—Business Meeting

President:
A. M. MOOD, General Analysis Corp.

8:00 P.M.

The Contributions of Karl Pearson

General Session, American Statistical Association–Institute of Mathematical Statistics

Chairman:
(To be announced)

Speaker:
HELEN WALKER, New York City

8:00-10:00 P.M.

National Long-Term Economic Projection—II: Developments in Projecting Productivity Trends

Business and Economic Statistics Section

Chairman:
JOHN W. KENDRICK, Bureau of the Budget and George Washington University

Papers:
"An Appraisal of Productivity Projections" by JAMES W. KNOWLES, Joint Economic Committee
"Recent Progress in the Analysis of Industrial Production and Productivity" by MILTON MOSS, Federal Reserve Board
"Underlying Factors in Productivity Advance" by NESTOR TERLECKYJ, National Bureau of Economic Research, Inc.

Discussion:
GERHARD COLM, National Planning Association
IRVING SIEGEL, Council of Economic Advisers
(One to be announced)

9:00 P.M.

Institute of Mathematical Statistics—1958 Council Meeting

President:
L. J. SAVAGE, University of Chicago

THURSDAY, SEPTEMBER 12

7:45 A.M.—Breakfast

Business and Economic Statistics Section—Business Meeting

8:30-10:30 A.M.

Developments in Methods for Short-Term Forecasting—III: Econometric and Other Techniques

Business and Economic Statistics Section—Econometric Society

Chairman:
SIDNEY ALEXANDER, Massachusetts Institute of Technology

Papers:
(Title to be announced) by SIDNEY ALEXANDER, Massachusetts Institute of Technology
(Title to be announced) by REX F. DALY, Dept. of Agriculture

Discussion:
LOUIS WEINER, Federal Reserve Board

8:30-10:30 A.M.

Distinctive Characteristics of Psychometric Statistics

Biometric Section—Biometric Society (ENAR)—Institute of Mathematical Statistics

Chairman:
GEORGE E. NICHOLSON, JR., University of North Carolina

Papers:
"Problems of Metric" by HAROLD GULLIKSEN, Educational Testing Service and Princeton University
"Problems Arising from Errors of Measurement" by FREDERIC M. LORD, Educational Testing Service

Discussion:
HERBERT SOLOMON, Columbia University
JOHN W. TUKEY, Princeton University

9:00-11:30 A.M.

Contributed Papers—I

Institute of Mathematical Statistics

Chairman:
ROBERT HOOKE, Westinghouse Research Laboratories

Papers:
(To be announced)

9:00-11:30 A.M.

Contributed Papers—II

Institute of Mathematical Statistics

Chairman:
JULIUS LIEBLEIN, Navy Dept.

Papers:
(To be announced)

10:30 A.M.-12:30 P.M.

Tolerances in Economic Projections and Forecasts

Business and Economic Statistics Section

Chairman:

WILLIAM H. SHAW, E. I. du Pont de Nemours & Company

Papers:

(Title to be announced) by AVRAM KISSELGOFF, Allied Chemical and Dye Corp.

(Title to be announced) by DAVID MELNICOFF, Pennsylvania Railroad Co.

Discussion:

DONALD J. WATSON, General Electric Co.

(One to be announced)

10:30 A.M.-12:30 P.M.

Clinical and Field Trials in Public Health and Medicine

Biometric Section—Biometric Society (ENAR)

Chairman:

JEROME CORNFIELD, National Institutes of Health

Papers:

"Retrolentral Fibroplasia, Clinical Trial" by F. M. HEMPHILL, University of Michigan

"Trials of Tranquilizers" by S. W. GREENHOUSE, National Institute of Mental Health

"The Joint Action of Drugs in Tuberculosis" by JACK WILLIAMS, Veterans Administration

"Sequential Procedures for Medical Trials" by PETER ARMITAGE, London School of Hygiene and National Cancer Institute

10:30 A.M.-12:30 P.M.

Capital Formation

Business and Economic Statistics Section

Chairman:

IRWIN FRIEND, University of Pennsylvania

Papers:

"Factors Affecting the Level of Fixed Investment for the Period 1951-1956" by MURRAY BROWN, University of Pennsylvania

"Interrelations of Investment and Sales Anticipations" by MURRAY FOSS, Dept. of Commerce

Discussion:

EDWARD F. DENISON, Committee for Economic Development

(One to be announced)

10:30 A.M.-12:30 P.M.

Applications of Fractional Replication Designs

Section on Physical and Engineering Sciences—Biometric Section—Biometric Society (ENAR)

Chairman:

JOHN M. WIESEN, Sandia Corp.

Papers:

"Fractional Factorial Experiments" by JOHN D. HROMI, U. S. Steel Corp.

"Application of Fractional Replications in the Food Industry" by MAVIS CARROLL, General Foods Corp.

"Industrial Experience with Fractional Replications" by CUTHBERT DANIEL, Private Consultant

10:30 A.M.-12:30 P.M.

Some New Studies of Unemployment

Social Statistics Section

Chairman:

WALT R. SIMMONS, Bureau of Labor Statistics

Papers:

"Unemployment Effects of a Major Plant Shutdown in a Depressed Area" by RICHARD C. WILCOCK, University of Illinois

"Worker Migration to a Newly Industrialized Area" by GERALD SOMERS, West Virginia University

"Worker Migration from an Area of Limited Job Opportunities" by RAYMOND D. LARSON, Bureau of Labor Statistics

"Labor Market Experience After Exhaustion of Unemployment Benefits" by LEO M. ORWICZ, Bureau of Employment Security

Discussion:

A. J. JAFFE, Columbia University

11:30 A.M.-12:30 P.M.

Wald Lecture—III

Institute of Mathematical Statistics

Chairman:

DAVID BLACKWELL, University of California, Berkeley

Paper:

"Polya-Type Theory" by SAMUEL KARLIN, Stanford University

12:00 Noon—Luncheon

Use of Census Tracts in Solving Business Problems

General Session, ASA

Chairman:

A. ROSS ECKLER, Bureau of the Census

Papers:

"Use of Census Tracts in Evaluating Volume of Sales and Selecting Sites for New Stores" by BENJAMIN FELSTEN, Food Fair Stores

"Utilization of Census Tract Data in Making Dealer Representation Surveys of Major Metropolitan Areas" by P. W. CZAMANSKE, JR., Ford Motor Co.

2:00-4:00 P.M.

Census Tract Tabulation Plans for the 1960 Census

General Session, American Statistical Association

Chairman:

HOWARD WHIPPLE GREEN, Cleveland Health Council

Speakers:

HOWARD G. BRUNSMAN, Bureau of the Census

WAYNE DAUGHERTY, Bureau of the Census

Discussion Period

2:00-3:00 P.M.

The Biometric Society (ENAR)—Annual Business Meeting

2:00-3:30 P.M.

Special Invited Paper

Institute of Mathematical Statistics

Chairman:

HAROLD HOTELLING, University of North Carolina

Papers:

"Estimation of Economic Relations" by CLIFFORD HILDRETH, Michigan State University

2:00-4:00 P.M.

Analysis of Consumption: Comparison of Aggregative Methods with Cross Sectional Analysis of Survey Data

Business and Economic Statistics Section

Chairman:

GUY H. ORCUTT, Harvard University

Papers:

"The Contribution of Cross-Sectional Survey Data to Prediction of Aggregative Components of Consumption" by HELEN HUMES LAMALE, Bureau of Labor Statistics

"Some Experiments with Demand Relationships for Clothing" by MORRIS HAMBURG, University of Pennsylvania

"Cross Sectional Data and Changes Over Time in Consumer Spending" by EUGENE CLARK and CHARLES A. YAGER, Federal Reserve Board

Discussion:

JEAN CROCKETT, University of Pennsylvania

VERNON G. LIPPITT, General Electric Co.

2:00-4:00 P.M.

Applications of Computers to Statistical Problems

General Session, ASA — Institute of Mathematical Statistics

Chairman:

JOSEPH F. DALY, Bureau of the Census

Papers:

(To be announced)

4:00-6:00 P.M.

Short-Term Demand for Consumer Durables and Housing: Research Methods

Business and Economic Statistics Section

Chairman:

GEORGE KATONA, University of Michigan

Papers:

"Demand for Housing" by ROBINSON NEWCOMB, Consultant

"Demand for Household Equipment" by VERNON G. LIPPITT, General Electric Co.

"Demand for Automobiles Based on Survey Data" by EVA MUELLER and CHARLES A. LININGER, University of Michigan

Discussion:

(To be announced)

4:00-6:00 P.M.

Diet and Heart Disease

Social Statistics Section—Biometrics Section—Biometric Society (ENAR)

Chairman:

(To be announced)

Papers:

"The Evidence Relating Diet to Coronary Heart Disease" by FELIX MOORE, National Institutes of Health

"The Problem of Cause and Effect in Heart Disease" by MORTON ROBINS, Veterans Administration

"Variations in Mortality from Heart Disease" by EDWARD A. LEW, Metropolitan Life Insurance Co.

Discussion:

(To be announced)

4:00-6:00 P.M.

Effect of High Speed Computing on Statistics

Institute of Mathematical Statistics—American Statistical Association

Chairman:

R. L. ANDERSON, North Carolina State College

Papers:

"Some Examples of Computer Applications in Mathematical Statistics" by GEORGE W. BROWN, University of California at Los Angeles and General Analysis Corp. and ALEX M. MOOD, General Analysis Corp.

"Making the Computer Cry 'Enough'!" by JACK MOSHMAN, Council for Economic and Industry Research

"Machine Generation of Normal Deviates and Their Application to Power Functions of Statistical Tests" by MERVIN E. MULLER, Princeton University and International Business Machines Corp.

Discussion:

(To be announced)

8:00-10:00 P.M.

Presidential Address—William R. Leonard

General Session, American Statistical Association

10:00 P.M.

Informal Party

American Statistical Association—Institute of Mathematical Statistics

FRIDAY, SEPTEMBER 13

8:30-10:30 A.M.

Contributed Papers

Section on Physical and Engineering Sciences

Chairman:

ERNEST G. BIANCO, General Electric Corp.

Papers:

"Modifications of the Correlation Technique for Use in a Process Capability Analysis" by DAVID COWAN, Ludlow Paper Company

"A Method for Continuously Sampling Sound Intensities" by WILLIAM GRODOWITZ, Elgin Air Force Base

"Probability of Runs (or Sequences) on Correlated Data" by RALPH H. BACON, General Precision Laboratory

"Using Pre-use Data to Predict Performance" by JOHN F. HOFMANN, Systems Laboratories Corp.

8:30-10:30 A.M.

Mixed Session

Biometric Section—Biometric Society (ENAR)

Chairman:

FELIX MOORE, University of Michigan

Papers:

"Evaluating Influences on Satisfaction with Patient Care in Hospitals through Multiple Regression Techniques" by EUGENE LEVINE and BENJAMIN BUCHBINDER, Public Health Service

"Inconsistency of Preferential Choice as a Measure of Psychological Utility" by C. H. COOMBS, University of Michigan

"Maximum Likelihood Estimation from Incomplete Data" by H. O. HARTLEY, Iowa State University

8:30-10:30 A.M.

Current Life Insurance Research on Owners and Buyers

Business and Economic Statistics Section

Chairman:

VIRGINIA HOLRAN, Institute of Life Insurance

Papers:

"Sample Surveys as a Tool for Obtaining Life Insurance Information" by EVA MUELLER, University of Michigan

"Characteristics of Life Insurance Sales and Buyers Which Influence Persistency in Premium Payment" by ALFRED G. WHITNEY, Life Insurance Agency Management Association

Discussion:

(Two to be announced)

8:30-10:30 A.M.

Measurement Errors in Sample Surveys

Social Statistics Section

Chairman:

LESLIE KISH, University of Michigan

Papers:

"The Influence of the Enumerator on the Accuracy of Population Census Results" by ROBERT H. HANSON, Bureau of the Census and ELI S. MARKS, National Opinion Research Center

"The Effect of Response Errors on the Census Statistics of Small Areas" by WILLIAM N. HURWITZ, Bureau of the Census

"Measurement Problems in Collecting Supplementary Data about Deceased Persons" by MONROE G. SIRKEN, Public Health Service

"On the Problems of Coverage in Samples of Dwelling Units" by IRENE HESS, Survey Research Center, University of Michigan

Discussion:

W. EDWARDS DEMING, Consultant in Statistical Techniques

JACOB J. FELDMAN, National Opinion Research Center

9:00-11:30 A.M.

Contributed Papers—III

Institute of Mathematical Statistics

Chairman:

JOHN GURLAND, Iowa State College

Papers:

(To be announced)

9:00-11:30 A.M.

Contributed Papers—IV

Institute of Mathematical Statistics

Chairman:

R. A. BRADLEY, Virginia Polytechnic Institute

Papers:

(To be announced)

10:30 A.M.-12:30 P.M.

Demand and Supply of Statisticians Now and in the Future

Section on Training — Institute of Mathematical Statistics

Chairman:

CARL F. KOSSACK, Purdue University

Papers:

"From the Standpoint of Government" by DAVID L. FUTRANSKY, Bureau of the Census

"From the Standpoint of Colleges" by T. A. BANCROFT, Iowa State College

"From the Standpoint of Industry" by CUTHBERT DANIEL, Private Consultant

"From a Survey of Both Industry and Colleges" by BOYD HARSHBARGER, Virginia Polytechnic Institute

10:30 A.M.-12:30 P.M.

Contributed Papers

Business and Economic Statistics Section

Chairman:

(To be announced)

Papers:

"A Price Index for Custom Made Products" by LLOYD SAVILLE, Duke University

"Labor Turnover Analysis" by JOHN E. ANDREW, The United Steel Companies Limited, England

"Accounting Records: A Limiting Factor in Economic Data Collection," by EDWARD T. CROWDER, Office of Statistical Standards

10:30 A.M.-12:30 P.M.

Contributed Papers

Biometric Section—Biometric Society (ENAR)

Chairman:

MORRIS D. FINKNER, Biometrical Services, ARS

Papers:

"A Note on Tukey's One Degree of Freedom for Non-additivity" by H. L. HARTER and MARY D. LUM, Wright-Patterson Air Force Base

"Current or Periodic Hospital Morbidity Reporting" by MARTA FRAENKEL, Dept. of Hospitals, New York

"Longevity as a Family Trait" by CHESTER ALEXANDER, Westminister College

"Quantitative Genetics of Behavioral Attributes" by JOHN L. FULLER, Roscoe B. Jackson Memorial Laboratory

"A Procedure for Removing the Effect of Response Bias Errors from Waterfowl Hunter Questionnaire Responses" by EARL L. ATWOOD, Dept. of the Interior

"Some Theoretical Considerations on Potentiation in Drug Interaction" by H. D. LANDAHL, University of Chicago

"Theoretical Distributions of Undisturbed Chromosome Lengths in the Gametes of F_1 and Backcross Generations" by W. D. HANSON, ARS, Biometrical Services

10:30 A.M.

Social Statistics Section—Business Meeting

10:30 A.M.

Section on Physical and Engineering Sciences—Business Meeting

11:30 A.M.-12:30 P.M.

Wald Lecture—IV

Institute of Mathematical Statistics

Chairman:

ALBERT H. BOWKER, Stanford University

Paper:

"Polya-Type Theory" by SAMUEL KARLIN, Stanford University

2:00-4:00 P.M.

Review of Agricultural Statistics

Social Statistics Section—Business and Economic Statistics Section

Chairman:

EARL E. HOUSEMAN, Dept. of Agriculture

Papers:

"A Program for Development of Crop and Livestock Estimates" by STERLING R. NEWELL, Dept. of Agriculture

"Farm Income Statistics: Methods and Meaning" by NATHAN M. KOFFSKY, Dept. of Agriculture

"An Appraisal of Some Agricultural Statistics" by LESTER S. KELLOGG, Deere and Company

Discussion:

BORIS C. SWERLING, Council of Economic Advisers

2:00-4:00 P.M.

Miscellaneous Session

Biometric Section—Biometric Society (ENAR)

Chairman:

WILLIAM HAENSZEL, National Institutes of Health

Papers:

"Prediction of Clinical Effects of Rh Incompatibility" by E. F. WILLIAMS, North Carolina State College

"An Application of Stochastic Processes to the Life Tables and the Standard Error of Age Adjusted Rates" by C. L. CHIANG, University of California

"The Development of Morbidity Survey Techniques for the National Health Survey Programs" by T. D. WOOLSEY, Public Health Service

2:00-3:30 P.M.

Special Invited Paper

Institute of Mathematical Statistics

Chairman:

WASSILY HOEFFDING, University of North Carolina

Paper:

"Distribution-free Methods in Statistics" by E. J. G. PITMAN, University of Tasmania and Stanford University

3:30-5:30 P.M.

Statistical Spectral Analysis of Stationary Time Series

Institute of Mathematical Statistics

Chairman:

JULIUS R. BLUM, Indiana University

Papers:

"On Asymptotically Efficient Consistent Estimates of the Spectral Density Function of a Stationary Time Series" by EMANUEL PARZEN, Stanford University

"The Prediction Problem and the Structure of a Class of Stationary Processes" by MURRAY ROSENBLATT, Indiana University

"On the Joint Estimation of the Spectra, Cospectrum and Quadrature Spectrum of a Two-Dimensional Stationary Gaussian Process" by N. R. GOODMAN, American Cyanamid Company and New York University

Discussion:

JOHN W. TUKEY, Princeton University and Bell Telephone Laboratories

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NOTE: The Econometric Society, also meeting jointly, is preparing several sessions. Its program will appear in the final printed program which will be available upon registration.

QUESTIONS AND ANSWERS

Edited by ERNEST RUBIN
U. S. Department of Commerce
and American University

The Significance of the Initiative in Chess

The importance of priority is commonplace and as such is embodied in folk sayings, e.g., "the early bird catches the worm." A type of behavior described as aggressive priority is known by the cliche "taking the initiative;" it is usually associated with situations requiring decisive action. The role of the initiative or first move assumes a special significance in a number of fields, such as business, law, warfare, politics and games. This is so because strategic or tactical considerations are an integral process within fields of activity that are competitive.

Whether explicit or implicit, the underlying assumption about the initiative is that in a field of strategic action the initiative either determines or significantly influences the final outcome. In effect, the first move is the beginning of a causation chain that leads to an inevitable result or conclusion.

Broadly speaking, there are three possible ways of characterizing the importance of the initiative. These are the two extremes indicating that the initiative is clearly favorable or unfavorable, and the third possibility, which locates the initiative between these extremes. My purpose is to evaluate the role of the initiative in the game of chess utilizing certain statistical evidence and tests.

Let us assume that two opponents, A and B, are equal players. If the first move (white) is of no consequence regarding the outcome of a game (and similarly for black, the second move), then if a sufficient number of games are played, A and B will win the same number of games. (Games ending in draws are not taken into consideration at the moment). An important problem is to satisfy the condition of players of equal strength.

I will first consider the results of master and grandmaster play in tournaments. There are two important advantages to be noted regarding this approach. The usual procedure of chess tournament play (other than elimination tournaments) is that each player meets his opponents twice, alternating the first move. This practice is equivalent to setting up an experimental control for eliminating the effect of the initiative. (Results whereby player A with white defeats player B, and draws against B when the colors are alternated, suggests the possibility that the first move is significant). The second advantage is that tournaments at this level presuppose a selection of players who have satisfied criteria for obtaining master rank.

W. Streeter in the *Chess Review* of May 1946 gave the results of chess games, by color played, in tournaments that took place in the period 1919-1932.[1] Streeter's data consist of 1,370 games; white won 507, black 356, and 507 were drawn. Omitting the drawn games, the proportion of wins for white is 507/863 or .587. On the assumption that the probability of a win is equally likely for either white or black the standard error of the proportion for this sample is .017.[2] The normal distribution test for the difference between the universe and sample proportion yields an extremely significant result.[3]

In 1953 the Grandmasters Challengers Tournament was held in Switzerland. The purpose of this tournament was to obtain a challenger to play against the world champion. Fifteen grandmasters participated in this tournament. Of the 210 games played, white won 49, black 43 and 118 games were drawn. Using the test described above to these data, no significant difference resulted between the observed and theoretical expectation. This tournament, consisting exclusively of grandmasters, satisfies more exactly the equivalence condition referred to earlier. To judge by the final scores of the players, however, there appears to be greater variation of strength among the players than the difference between the first and second moves.

In the recent world championship match concluded in April 1957, the challenger Smyslov defeated the world champion Botvinnik by a score of 6 to 3 wins, with 13 draws. Of interest is the point that the white forces won 6 and the black 3 games. The result is not statistically significant. In the challenge match of 1927 when Alekhin defeated Capablanca the score in wins was also 6 to 3, with 25 draws. In this match, white also won 6 and black 3 games. This result was likewise not significant. In both matches the defeated world champions were able to win only with the white forces!

To shed further light on the problem of the initiative in chess requires extensive analysis of data by type

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[1] I wish to acknowledge the assistance of Mr. Edmund Nash, nationally recognized chess expert, contributor to the semi-monthly newspaper *Chess Life*, and member of the Washington Chess Divan. Mr. Nash kindly furnished some of the data and discussed various features of the analysis relating to chess.

[2] Using $\Sigma_p = \sqrt{\frac{pq}{N}} = \sqrt{\frac{(.5)\,(.5)}{863}} = .017$

[3] The test $\frac{x}{\sigma} = \frac{p_s - p_u}{\Sigma_p} = \frac{.587 - .5}{.017} = 5^+$

of openings, length of games in moves, etc. This remains to be done. In lieu of this I obtained a number of chess compilations based on selection criteria that *appear* to be independent of the variable under examination. Irving Chernev's *The Russians Play Chess*, contains 50 master games covering the period 1925-1945; white wins 30, black 20 games.[4] Reuben Fine in *Chess Marches On* selected 50 illustrative master games; white won 28, black 19 and 3 games drawn.[5] In neither case were the results statistically unusual.

A slight change of emphasis in the matter of game selection for various compilations throws further light on the complexity of the initiative problem. H. Golombek's *Capablanca's Hundred Best Games of Chess*, gives 69 wins for white, 29 for black and 2 drawn.[6] These results are very highly significant in favor of white. I am certain that Golombek's criteria for selection of games was not a preference for white. The division between white and black victories suggests a positive value to the initiative in chess because the *best* results were obtained more frequently with the white pieces. I believe that an analysis of Capablanca's tournament record would reveal another facet to this problem. He played a total of 480 tournament games between 1910 and 1939. He won 277 games, lost 26 and drew 177, certainly an incredible record in the history of chess.[7] I suspect that an analysis of the games drawn and lost would reveal that Capablanca was playing the black pieces in most of these games.

In *My Best Games of Chess, 1924-1937* by Alexander Alekhin, the late world champion selected 104 games; 71 wins are with white and 33 with black.[8] As in the case of Capablanca, the result is highly significant in favor of white. And to conclude the "best" games selections, I examined *The World's Great Chess Games*, edited by Reuben Fine, which covers a century of chess, circa 1851-1951.[9] Of 188 games, there are 128 wins by white and 60 by black. The result is again significantly in favor of white.

The statistical evidence and the tests thereof are more suggestive than conclusive in resolving the question posed here. The initiative in chess appears to lie between the extreme possibilities, tending in the direction that considers the initiative clearly favorable. If considerations regarding the initiative are extended,[10] e.g., the rapidity of achieving victory or the brilliance in obtaining the decision, then analysis of additional data will be required. It is my impression that the initiative in chess leads to quicker and more elegant wins.

[4] David Mackay, Philadelphia, 1947.
[5] David Mackay, Philadelphia, 1945.
[6] Harcourt Brace, New York, 1947.
[7] Ibid., page 21.
[8] Harcourt Brace, New York, 1939.
[9] Crown Publishers, New York, 1951.
[10] Mr. Nash believes that if white has an advantage over black then as the chess master ages he will win or draw more frequently with white and win less frequently with the black pieces than in the earlier period of his career. This idea ties in with R. Fine's thesis that master chess is a young man's game.

QUESTIONS AND ANSWERS CORRESPONDENCE

I believe the following letter will be of interest to our readers and I hope that it will provoke discussion along the lines indicated.

April 18, 1957

Dear Dr. Rubin:

An article by K. A. Brownlee in the March 1957 Journal of the American Statistical Association considers the effects of non-response on surveys, with specific reference to J. Berkson's analysis of possible errors in the American Cancer Society study of smoking and lung cancer. Brownlee's algebraic analysis leads to the conclusion that under certain conditions Berkson's model would be unable to account for the difference in death rates between smokers and non-smokers found by the American Cancer Society. This is a valuable analysis but I do have some questions about the concluding paragraph in which Brownlee goes on to say that if these conditions are known to prevail

> ". . . then we cannot account for the whole of the difference between death rates by differential sampling and an alternative hypothesis must be sought: for example, we might suppose that the hypothesis that the death rates for smokers and non-smokers are the same may need to be abandoned. *However, this does not seem to be a very satisfactory basis for making statistical inferences; it amounts to saying 'Granted my sampling scheme is poor, it is not that poor'. While we may make decisions in everyday life on this basis, it seems hardly good enough for the formulation of scientific conclusions.*" (italics mine)

This sent me back to my old lecture notes on statistical inference (by Prof. I. Q. Bickerstuff) where the process of rejecting a null hypothesis was explained in exactly these words (so help me), "It amounts to saying 'granted my sample is small, it is not that small'. What I want to know is why does Prof. Bickerstuff's statement become unscientific when "poor" is substituted for "small", or is statistics unscientific (or is it only some statisticians)?

Also, some 20,000 to 25,000 people die every year in this country of lung cancer. Does this belong to "everyday life" in which case we can reject Berkson's hypothesis if we believe the conditions are satisfied, or is it a part of science in which case, as I understand it, we can't?

Perplexed. but still smoking

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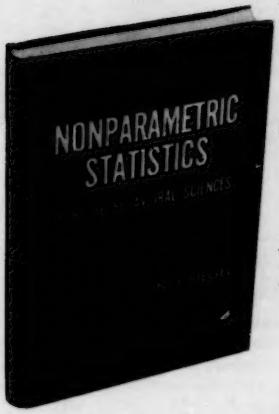

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NEWS ABOUT MEMBERS

Allan G. Anderson has resigned his position as Mathematician in the Glass Division Research Laboratory of the Pittsburgh Plate Glass Company and is now employed as Chief Statistician at the General Tire & Rubber Company in Akron, Ohio.

George E. Bardwell, formerly with the Denver Research Institute, has been appointed to the staff of the Statistical Research Division, Bureau of the Census.

J. Thomas Breen, formerly in the Prices and Values Branch, Agriculture Division, Bureau of the Census, has been named Chief of the Farm Products Branch.

J. D. Colman, formerly Vice President of The Johns Hopkins University and the Johns Hopkins Hospital, has been elected Vice President and Secretary of the National Blue Cross Association. Among Mr. Colman's responsibilities will be direction of the research activities of the Association.

Thomas F. Corcoran, formerly in the International Statistical Programs Office, Bureau of the Census, has been appointed Emergency Planning Officer of the Bureau.

Tom Donnelly received a Ph.D. degree in Statistics in June, 1957 at the University of North Carolina, where he has accepted a position as Research Associate Professor in the Department of Biostatistics. He was formerly with the Bureau of Statistics, Ottawa.

Churchill Eisenhart, Chief of the Statistical Engineering Laboratory at the National Bureau of Standards, has been awarded the Department of Commerce Gold Medal for Exceptional Service, the Department's highest employee honor. The award recognizes his "leadership in integrating modern statistical development with experimental research in the physical sciences, distinguished authorship, and outstanding contributions to the public service."

Grover W. Ensley has resigned as Executive Director of the Joint Economic Committee, U.S. Congress, effective June 1, to become Executive Vice President of the National Association of Mutual Savings Banks in New York.

Seymour Etkin, formerly Chief of the Current Retail Tabulation Section in the Economic Operations Division, Bureau of the Census, has transferred to the Program Research and Coordination Branch, Business Division.

Edgar R. Fiedler is now with the Statistical Department of the Eastman Kodak Company, Rochester, New York.

Barbara Fox has joined Trans World Airlines, Inc., as an analyst in the Economic Planning Department in New York.

Norman R. Garner has resigned as Consulting Statistician to the Naval Powder Factory, Indian Head, Md. He is now with the Reliability Control Staff of the Aerojet-General Corporation.

Kenneth Harwood, Chairman of the University of Southern California's Department of Telecommunications, was elected president of the Association for Professional Broadcasting Education during the group's annual meeting in Chicago. The Association consists of 45 colleges and universities that offer major study of radio-television broadcasting and the National Association of Radio and Television Broadcasters. Its purposes include the development of radio-television studies through collaboration of educators and broadcasters.

Helen R. Jeter has been appointed Chief of the Program Analysis Branch in the Division of Research of the Children's Bureau, Social Security Administration, to succeed Edward E. Schwartz who resigned in February. Dr. Jeter joined the staff of the Division of Research last August as Chief of the Child Welfare Statistics Section.

Edward L. Kaplan is on leave of absence from the Mathematical Research Department, Bell Telephone Laboratories, Murray Hill, N. J., until next January. Currently, he is dividing his time between a position as Mathematician in the Theoretical Division, University of California Radiation Laboratory, Livermore, Calif., and independent research.

Nathaniel R. Kidder has resigned from his position as Vice-President of Technical Marketing Associates, Inc., in order to accept the presidency of Kidder and Company, Harvard Square, Cambridge, Massachusetts, a consulting firm specializing in the field of industrial marketing. Mr. Kidder has been named General Chairman of the 1958 national convention of the American Marketing Association which will be held at the Harvard Graduate School of Business Administration in June of next year.

Emanuel Landau, formerly Chief of the Family Statistics Section, Population Division, Census Bureau, has transferred to the U.S. Public Health Service and is working with the Bureau of State Services in California.

Norman Lawrence, formerly Assistant Chief, has been named Chief of the Foreign Manpower Research Office, Bureau of the Census.

Eugene H. Lehman, Jr., Assistant Professor of Statistics, University of Florida, who was erroneously reported in the April issue as having taken a position with Bell Aircraft, will become Senior Research Engineer in the Systems Analysis Group, CONVAIR, San Diego. His new work will involve "statistical analysis of performance of complete weapons systems and optimization of design for Atlas Missile project."

John W. Lehman, who has served as clerk of the Joint Economic Committee, U.S. Congress, since its staff was first organized in 1947, has been designated Acting Executive Director, pending final action by the full committee to fill the place vacated by Mr. Ensley.

Eugene Lukacs of the Mathematics Department of the Catholic University of America has been granted leave in order to permit him to accept an invitation to give several lectures at the Sorbonne (Paris).

Wendell D. MacDonald, Director of the New England Region, Bureau of Labor Statistics, has been given a Rockefeller Public Service Award to study the social and economic adjustment to automation, and the similar adjustment in the 1890's to the coming of age of factories in this country.

W. Parker Mauldin has joined the staff of The Population Council, New York City, and has left his post as Chief, Foreign Manpower Research Office, Bureau of the Census.

Frank Meissner, formerly with the Department of Agricultural Economics, Cornell University, accepted a position as Analyst in the Market Research Department, Crown Zellerbach Corporation, San Francisco. He is also a Lecturer on Business Statistics at Golden Gate College.

Walter Mitchell, Jr., of the Case Institute Management Development Program at Cleveland, has been asked to prepare the American paper on the subject "Exchange of Information—Between Business Enterprises—Between Business and Government," for the International Management Congress scheduled in Paris at the end of June.

Mohamed Jamal Mohideen is at present enrolled in the Graduate School of Arts and Sciences of the University of Pennsylvania where he is studying for a Ph.D. degree in Economics.

H. V. Muhsam has been appointed Social Affairs Officer at the U.N. Headquarters, New York, where he will assist the Assistant Director, in charge of Population, of the Bureau of Social Affairs, in the various activities of the Population Branch.

David F. Newman, formerly Quality Control Engineer, Research & Development Department, Colgate-Palmolive Company, Jersey City, is now Industrial Engineer, Manufacturing Planning Department, International Business Machines Corporation, Rochester, Minnesota.

Robert F. Pearse is now Personnel Development Director of Mead Johnson & Company, Evansville, Indiana.

Enzo A. Puglisi, Chief of the Section of Special Studies, Productivity Division, Bureau of Labor Statistics, has undertaken a one year assignment with the ICA Technical Assistance Mission to Greece to work with the Greek Government in organizing the statistics program of the Ministry of Labor.

Israel Putnam has joined the staff of the Branch of Housing and Rents, Division of Prices and Cost of Living, Bureau of Labor Statistics.

Robert Schrage has joined the Stouffer Corporation of Cleveland as Manager of Market Research for the Frozen Foods Division. He was formerly with the Ferro Corporation.

Edward E. Schwartz, formerly Chief of the Program Analysis Branch, Children's Bureau, has resigned to become Professor of Social Welfare Administration and Director of the Social Service Program in the Graduate School of Public Administration and Social Service, New York University.

Allan Searle, formerly of the Division of Productivity and Technological Developments, is now Chief of the Section of Consumer Price Indexes of the Division of Prices and Cost of Living.

Bud Sherak, Director of Research for Kenyon & Eckhardt, Inc. for the past year, has been elected a Vice-President of the advertising agency.

Max Shor has transferred from the Office of the Assistant Chief for Mineral Industries, Industry Division, to the Economic Statistics Branch, Population Division, Bureau of the Census.

Martin Shubik, formerly in the Department of Economics at Princeton University and at the Center for Advanced Study in the Behavioral Sciences, has joined the Management Consultation Services of the General Electric Company where he is primarily engaged in research work on decision-making under uncertainty.

Howard L. Stier, Director of Statistics and Marketing Research, National Canner's Association, has been elected a Director of the American Marketing Association.

James M. Vicary, head of the Vicary Company, acted as consultant for an advertising-editorial readership study at the Instrument Society of America show at New York's Coliseum.

Hugh G. Wales, Professor of Marketing, University of Illinois, has been elected a Vice-President of the American Marketing Association.

Sir Arthur Lyon Bowley, C.B.E., distinguished British statistician, died on January 21 at the age of 87. He graduated from Cambridge University, receiving the degree of Sc.D. in 1913. From 1895 to 1936 he taught statistics and mathematics at the London School of Economics, at first on a part-time basis during a period when statistics was not taught as a separate subject at any other British university, and later as holder of the new chair of statistics. After his retirement in 1936 he was called upon to act as director of the Oxford University Institute of Statistics during the war period 1940-44. Professor Bowley contributed much to the application of statistics to economic and social problems, as well as to the advancement of statistical and economic theory. He was the author of "Wages and Income in the United Kingdom since 1860," textbooks on statistics, and numerous other books, articles and reports. He was President of the Royal Statistical Society from 1938-40, and of the Econometric Society in 1938; Honorary President of the International Statistical Institute, and a Fellow of the British Academy. He was also an honorary member of A.S.A.

Mr. Norman R. Stocker, prominent member of the Detroit Chapter, died January 27 in Detroit, Michigan. Mr. Stocker was a graduate of University of Detroit (B.S. 1938) and Georgetown University (M.A. 1940). He was employed by the War Production Board as Regional Personnel Officer, subsequently taught at Marygrove College and the University of Detroit, and later was an economist with the Brookings Institution, The Automobile Manufacturers Association and Studebaker-Packard Corporation. His writings were published by the Review of Social Economy, the Social Justice Review, the National Automobile Dealers Association and the A.M.A. He was also a member of the American Economic Association, the Econometric Society and the Catholic Economic Association. He is survived by his wife and three children.

CHAPTER NOTES

Albany

A panel meeting was held on April 17th on the subject, "Role of the Statistician in State Research Organizations." Karel F. Ficek, Chief of Planning in the Division of Employment of the New York State Department of Labor, acted as moderator; and the members of the panel were Irma Rittenhouse, Director of Research, Division of Employment; William E. Zimmerman, Director of Research, Department of Commerce; and Dr. Chester B. Pond, Director of Research, Department of Taxation and Finance.

The Fourth Annual Conference on Government Statistics was held on May 23rd at the Sheraton-Ten Eyck Hotel. The theme of the conference was "Statistics Applied to Community Problems." The keynote address was given by Herman E. Hilleboe, M.D., Commissioner of the New York State Department of Health. The subject of the morning panel was "How Statistics Have Been Used to Chart the Course for New Programs of Care of the Mentally Ill." Robert E. Patton, Director of Statistics, New York State Department of Mental Health, was chairman, and the speakers were Ernest M. Greenberg, M.D., Technical Consultant, Milbank Memorial Fund, and Henry Brill, M.D., Assistant Commissioner, New York State Department of Mental Hygiene. At the luncheon meeting, Hon. Jonathan B. Bingham, Secretary to the Governor, spoke on "The Governor's Office as a Consumer of Statistics." The subject of the afternoon panel was "Use of Population Statistics for Community Planning." The Chairman was George B. Robinson, Director of the Bureau of Planning, New York State Department of Commerce, and the speakers were Richard May, Director of Planning, Rockland County, and Henry Cohen, Senior Management Consultant, Office of the City Administrator, New York City.

Boston

At the meeting of the Boston Chapter on March 5th, Dr. Max A. Woodbury outlined the history of the statistical engineering laboratory at New York University and discussed some of its accomplishments. The question period afforded an opportunity for consideration of problems common to all computing and statistical services. It was evident that the most irksome problem at the present time is the shortage of applicants with training and aptitudes for programming and other phases of the work of such services.

On April 10, the chapter and the Boston Section of the American Society for Quality Control held a joint meeting to hear A. C. Rosander of the Sampling and Estimating Division of the Federal Internal Revenue Service speak on quality control in clerical work, one of the special projects. Another special project is the cost study, from which salary and machine rental costs are estimated; this use of a sample method of estimation for costing is unique in work sampling.

Mr. Rosander described the probability sample of less than one percent of the returns filed by taxpayers which provides maximum information on the quality of performance of taxpayers; the greatest source of error is under-reported income; arithmetic errors are minor. A probability sample of case files (tax returns selected for audit) measures the department's audit effort and productivity under the decentralized program in 64 district offices.

Central New Jersey

A meeting was held on May 14th at Princeton University at which Professor Philip E. Vernon spoke on "Measuring the Effectiveness of Radio Educational Talks." Professor Vernon, who is Professor of Educational Psychology at the Institute of Education, University of London, is visiting the Educational Testing Service and other institutions in the United States.

Chicago

The March 28th dinner meeting heard a talk on "Long-Term Growth Trends in the U.S. Economy—A Look Ahead" by L. Chester May, Chief Statistician, American Telephone and Telegraph Co., New York. Mr. May discussed the future trends in household formation, labor force,

productivity, gross national product, consumer incomes, etc. and the implications for business forecasting and long-range planning. At a luncheon meeting on March 21st "Uses of Probability in Management Controls" was discussed by Lucile Derrick of the University of Illinois and Martin Wiberg of Martin Wiberg & Co.

"How to Stimulate Creative Thinking in an Organization" was the subject of the April 25th dinner meeting, which was held jointly with the Chicago Chapter of the American Marketing Association. The speaker was Frederic D. Randall, Manager of Merchandising, Agricultural and Industrial Products Division, Eli Lilly Co., Indianapolis. Luncheon meetings were held on April 2nd and April 19th. At the first of these, Dr. Burleigh B. Gardner, Executive Director of Social Research, Inc., spoke on "More Effective Marketing Through Knowledge of Brand and Company Images." At the second, Dr. Jack Brickhouse, Sports Director of WGN, discussed "Application of Statistics to Baseball."

The May dinner meeting was held on the 16th, with Dr. Harold T. Davis, professor of Mathematics at Northwestern University, as the speaker. Professor Davis' subject was "Cyclical Fluctuations in Consumer Income Distribution." At the May 7th luncheon meeting Don Klein, Research Manager, the Chicago Tribune, spoke on "The Chicago Tribune Consumer Panel—Theory, Practice and Application to Marketing Problems." "The Chicago Area Transportation Study—Objectives, Methods and Sample Design" was discussed by J. Douglas Carroll, Study Director, at the May 16th luncheon.

Cleveland

A talk on "The Use of Models in Business" was given by Morris J. Solomon, Senior Operations Research Analyst, American Greetings Corporation, at the February 26th meeting. Mr. Solomon outlined the main features of mathematical models and their chief advantages. He stressed the need of a close partnership of the model maker and operating personnel. Viewing of the mathematical model as a tool which extends judgment and experience in a complementary way, makes partnership with operating personnel more fruitful. "A reasonably bright man on the line, when teamed up with even a dull mathematician or statistician, can be very effective, providing they learn to talk to each other." Another profitable view is that a model is a simulation of reality. Mr. Solomon gave illustrations of some major types of models. He then discussed two models used in his work. First was the Economic Lot Size Model, and second was a model describing growth relationships governing a company's growth. The latter model facilitates decisions on company growth policies.

At the March 26th meeting, Frank W. Wehrfritz of the Standard Oil Company of New Jersey addressed the group on the subject, "Strategy in Research." Mr. Wehrfritz explained the operation of the Easo "Black Box," a device composed of a series of electrical resistance networks, batteries and milliameters, originally designed as a teaching device and subsequently found to be useful as a research tool in the area of design of experiments. The "black box" is useful for determining the various strategies used in problem solving. Mr. Wehrfritz discussed a model of an alcohol plant and the use of the "black box" to improve the yield by adjustment of the four operating variables. The object was to obtain an optimum setting of the dials with the fewest number of manipulations. Mr. Wehrfritz concluded by summarizing the fundamental mistakes made in doing research and outlined the elements needed for development of the best strategy in any game situation.

Members of the group were then requested to test their strategies in solving the riddle of the "box."

Denver

The March Workshop Meeting, held in the Briefing Room of the United Air Lines, was a stimulating experience. Loren L. Straw, Briefing Room Analyst, conducted the meeting, discussing some of the business techniques which make management's job easier and more effective. These techniques involve the development of a few basic indicators to measure and reflect all significant elements of performance simply and forcefully. The use of visual communication is very important, and Mr. Straw displayed the visual aids used in the daily briefings of United Air Lines management. Part of the workshop consisted in visiting the laboratory where the visual aids are produced.

The speaker at the dinner meeting of April 25th was Scott Hazen, Jr., Mining Research Engineer with the Denver Experiment Station of the United States Bureau of Mines. Mr. Hazen, who is one of the few recognized authorities in the country in the application of statistics to mining engineering, discussed the background and potentialities of statistical analysis in this field.

Detroit

Dr. Benjamin Epstein, Wayne State University professor of mathematics, spoke on "Game Theory and Statistics" at the April 11th meeting. Dr. Lawrence Seltzer, Chairman of the Department of Economics at Wayne State University, presided.

Montreal

The guest speaker at the meeting held on March 19th was Mr. K. W. Halbert, Supervising Statistician, American Telephone and Telegraph Company. The subject of Mr. Halbert's talk was "Sampling in Business Administration and Operations." He outlined in non-technical language some of the basic aspects of modern scientific sampling, and by means of numerous slides, dealt with the reliability, efficiency and economy of a variety of sampling plans.

On April 10th, Prof. Jacques St. Pierre of the University of Montreal spoke to the Chapter on "The Design of Experiments." He opened his talk by outlining the historical development of statistical design in experimentation, and reviewed some of the early contributions of Sir R. A. Fisher. Using some simple experiments as examples, he illustrated the pitfalls involved in planning an experiment and in interpreting the results. The problems of size and arrangement of an investigation were then discussed.

The small discussion group which had been formed by the Technical Committee earlier in the year met again on April 24th. The topics for discussion were factorial chi-square analysis, and the problem of heterogeneity of variance in regression analysis. The advantages and disadvantages of existing techniques were discussed at length.

New York

"Diffusion Indexes, a New Forecasting Tool," was the subject of a meeting held on March 14th. The speakers were Geoffrey Moore, National Bureau of Economic Research, who spoke on the history and meaning of diffusion indexes; Albert T. Somers, National Industrial Conference Board, who discussed the utility of the indexes; and Professor Henry Ernst, Tufts College, who gave a critiques of the indexes.

At the meeting of March 28th, Milton E. Terry, Bell Telephone Laboratories, discussed "A Long Tail Distribution for Social and Economic Models," and Robert E. Johnson, Western Electric Co., spoke on "Mathematical Models Hit Pay Dirt."

The meeting of April 10th was devoted to a discussion of new forecasting tools. Morris Cohen, National Industrial Conference Board, spoke on "Capital Appropriation Series," and Douglas Greenwald, McGraw-Hill Publishing Co., discussed "A Forecast Index of New Orders for Machinery."

Two meetings on electronic computing machines were held on April 25th and May 1st. At the April meeting, their statistical application and techniques as applied to physical sciences and engineering was described by Harry Weingarten of Remington-Rand and Dr. Z. Szatrowski of I. B. M. The subject of the May meeting was the application of the machines to biometrics, the speakers being Dr. Max Woodbury of Columbia University and Minot R. Bridgham of Metropolitan Life.

The subject of the May 8th meeting was "Stock Market Averages: Which One is Best?" The chairman was Robert L. Tebeau, Merrill Lynch, Pierce, Fenner and Beane; and the speakers were Burton Crane, New York Times; Lewis L. Shell-

back, Vice President of Standard and Poor's Corporation; and Arnold Bernhard, Arnold Bernhard and Co.

Oklahoma City

New officers were elected at the annual meeting in January. They are:

President—Francis R. Cella, Bureau of Business Research, University of Oklahoma

First Vice-President—Neil J. Dikeman, Bureau of Business Research, University of Oklahoma

Second Vice-President—Edward Manske, Republic Supply Co.

Secretary-Treasurer—Mrs. Ellen Bryan, Federal Housing of Oklahoma

The speaker of the February 21st meeting was William Wilcutt, Economic Analyst, Haliburton Oil Well Cementing Company, Duncan, Oklahoma, who spoke on the subject, "Monte Carlo Techniques." Mr. Wilcutt discussed the use of probability concepts in games of chance and then related the principles to decision-making in business wherein random elements are present. He showed how the random aspects may be brought under control by use of Monte Carlo techniques as they relate to Queueing problems, Game Theory, and similar statistical applications. Thirty-two members were present at the meeting.

The Chapter held its April meeting on the 21st with thirty-two members. The speaker was James Powers, Operations Analyst, Boeing Aircraft Company, Wichita, Kansas. Mr. Powers spoke on the subject of Operations Research, discussing the history and concepts of operations research. The principles of Linear Programming, Game Theory, Learning Curves, and Queueing Theory were developed in connection with the problems of the aircraft industry and other industries.

Southern California

The subject of the dinner meeting held on April 25th was "Forecasting Methods." A. Vern Engel, General Commercial Manager, and James W. Davis, Development Engineer in charge of the forecasting group of the Commercial Engineer's Office, Pacific Telephone and Telegraph Co., discussed particularly forecasting as used by the telephone company.

The May 23rd dinner meeting heard a talk by Fred C. Selzer, Jr., Manager of the Market Research Department of the Times-Mirror Co., on "The Use of Market Research by the Times-Mirror Company." Mr. Selzer discussed the way the Los Angeles Times and its companion newspaper, the Mirror, use statistics to aid in maintaining their place in the competitive field.

Washington, D. C.

A panel meeting was held on March 25th on the subject of "International Technical Assistance in Statistics: Progress and Problems." Emerson Ross, Chief of the Economic Development Division, Bureau of Economic Affairs, Department of State, was chairman. Peyton Stapp, Assistant Chief of the Office of Statistical Standards, Bureau of the Budget, spoke on "Organization of National Statistics in Relation to National Planning," describing the basic statistics needed by under-developed countries in particular. Forrest Linder, Director of the National Health Survey Program, Department of Health, Education and Welfare, discussed "Outlook and Needs for National Statistics," pointing out that although there has been a great increase in statistics in the last few years, there are many needs still not satisfied. Discussants were Robert L. Sammons, Chief of the Latin-American Section, Federal Reserve Board; Samuel J. Dennis, Office of Statistical Standards, Bureau of the Census; and Jacob Perlman, Study Director of Surveys, National Science Foundation.

The April 29th meeting was devoted to the topic, "The Use of Experimental Designs in Industry." Dr. H. C. Hamaker, Chief Statistician at Philips Research Laboratories, The Netherlands, and Visiting Professor at Rutgers University, was the speaker. Discussants were Dr. Ronald G. Herd, Consultant, Aeronautical Radio, Inc., and N. C. Severo, Mathematician, National Bureau of Standards. Besse B. Day, Consulting Statistician, Bureau of Ships, U. S. Navy Department, was chairman. A number of histories of situations where modern experimental designs were used in industry were illustrated with slides, and the basic requirements for success in the field were discussed.

The subject of the May 20th meeting was "Problems Involved in Quantitative Analysis of the Fallout Hazard." Mr. Marshall Wood, Chief of the Industrial Vulnerability Branch, Department of Defense, introduced the problem and acted as moderator. Dr. Lester Machta, Chief of the Special Projects Section of the Office of Meteorological Research, U. S. Weather Bureau, spoke on the current status of fallout area prognosis; Dr. George P. Cressman, Director of the Joint Numerical Weather Prediction Section, U. S. Weather Bureau, described the current status of upper wind predictions by numerical methods; and H. Burke Horton, Director of the National Damage Assessment Center, Office of Defense Mobilization, discussed the operational and research requirements of a fallout computation procedure. The talks were followed by questions and discussion from the floor.

The following officers have been elected for 1957-58:

President—MARGARET E. MARTIN, Bureau of the Budget

Vice President—HAROLD DORN, National Institutes of Health

Secretary-Treasurer — EDWIN D. GOLDFIELD, Bureau of the Census

Executive Committee—BESSE B. DAY, Department of the Navy. DAVID L. KAPLAN, Bureau of the Census. SOLOMON KULLBACK, Department of Statistics, George Washington University.

Twin Cities Organizing New Chapter

One-hundred local statisticians met March 13th in St. Paul to take steps toward forming a Twin Cities chapter of the American Statistical Association. Chairman of the meeting was Richard L. Kozelka, Dean of the School of Business Administration at the University of Minnesota. Guest speaker was the well-known statistician and mathematician, Dr. Thornton C. Fry. Dr. Fry spoke on "The Fundamental Concepts of Probability."

An interim executive committee of six members was elected to carry on program planning until officers are elected. Thereafter the committee will serve in an advisory capacity for the remainder of the year. Members are:

Gweneth Hedlund, General Mills
Gordon Johnson, Minneapolis Honeywell
Mitchell O. Locks, Remington Rand Univac, Div. of Sperry Rand Corp.
John MacDonald, Federal Reserve Bank of Minneapolis
John Neter, University of Minnesota
Ray Solem, Minnesota Division of Employment and Security

Appointed to serve on the nominating and charter committees were:

Nominating

Gayle W. McElrath, Chairman, University of Minnesota
Will Kissick, Minnesota & Ontario Paper Company
Ray Solem, Minn. Div. of Employment & Security

Charter

Roy B. Jewett, Chairman, International Milling Company
Jacob E. Bearman, University of Minnesota
Abe Bluestone, Remington Rand Univac

Officers will be elected and a constitution presented at the next meeting.